MODERN PLASTICS

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JULY, 1936 VOLUME 13 NUMBER 11

• OF GENERAL INTEREST

• TECHNICAL SECTION

• NEWS AND FEATURES

PIERRE CHERON

NEXT MONTH

Pierre Chéron, designer of the old school with a fine arts background and a twelve year service record with Tiffany, will express his views on modern design in an interesting story entitled "Where do we go from here."

Mr. Chéron has recently designed some attractive boxes and trays of plastic which will be used to illustrate his interpretation of Modern.

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MODERN PLASTICS

BRESKIN AND CHARLTON PUBLISHING CORP.
425 FOURTH AVENUE NEW YORK, N. Y.

JULY 1936 VOLUME 13 NUMBER 11

The silent partner of broadcasting

BY BLAINE STUBBLEFIELD

ELECTRONICS came of age in the postwar period as a contemporary of plastics, whose dielectric and structural qualities have been recognized and applied to radio broadcasting and reception from the beginning. Their use is increasing constantly.

In general, the application of plastics in electronics is considered from two distinct points of view. First, mechanical properties such as strength, color and texture. Second, electrical characteristics, which are dielectric strength or resistance to losses under the stress of high frequencies. High frequencies are associated with short wave output. Frequently, a plastic designed for the best mechanical qualities will not serve the electrical ends desired, and vice versa.

The advantage of color in broadcasting is well illustrated in the new portable microphone stands built for WOR by Ray S. Lyon, development research engineer of the company. The chief objective in this new design is to obtain a microphone ensemble for use at public gatherings which looks more like a fine piece of furnishing than like a piece of machinery. Mr. Lyon selected the Chinese modern motif, and chose Marblette "Ama-Tran," made by the American Transformer Co., to make the pagoda-shaped cover for the steel plate base. It is mottled jade green, in keeping with the Chinese motif. Another part made of this material, to carry out the ensemble, is a small collar near the top of the fixed section of the stand, which telescopes for height adjustment. Both parts are machined from solid and tube stock. The cord runs through the hollow stand tube, projecting at a convenient angle from the curved section near the base. The tall stand is for speakers standing, and the short one is for sitting talkers. The power supply unit that goes with this equipment is set in a drilled and mortised panel of white Marblette, a cast resin material.

This is the first attempt to bring out a microphone stand harmonious with a banquet table or auditorium. Heretofore such instruments have been limited in line and form to mere mechanical and electrical requirements often incongruous to surroundings. It indicates how the versatility of color in plastics is coming to be used in broadcasting showmanship.

Hello Everybody!

"Broadcasting is show business," said Mr. Lyon, "and that should apply to its visual aspects as well as to its auditory output. The show qualities of plastics,

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1. Colored cast resins give these microphones a decorative appearance that lifts them from purely mechanical design. **2.** WOR's chief engineer, J. R. Poppele, and development research engineer Ray S. Lyon, standing at selector mechanism which is mostly all plastics of various kinds. Radio receivers behind them are of laminated phenolic. **3.** Telegraph instrument inset in desk at WOR has molded base, top and bottom. Control buttons, keys, meter cases and all insulation in this room are either molded or laminated plastics. (Illustrations courtesy Station WOR). **4.** NBC studio monitoring booth where programs are watched and timed. Studio engineers at right get proper "level" for the various parts of the program. Switch control boards are laminated phenolic—knobs are molded. **5.** Control board for the power room in NBC's new studios at Radio City. The huge motors and dynamos which supply the power to carry programs to the coast-to-coast networks are controlled from this laminated panel with plastic knobs and switch handles. Switch bars are also laminated phenolics. **6.** Main control desk, or nerve center of NBC studios. The lights represent the different studios and ninety-six stations on the coast-to-coast networks which the operator controls at these laminated panels. **7.** NBC's new micro-wave transmitter, wave length one meter or less. Its range is only three or four miles, but it's no bigger than an ordinary microphone and can be carried in a handbag to any place where there's sound worth listening to. A "mother" station, nearby, picks up the "program" and rebroadcasts it. Antenna supports, condenser mountings, microphone housing, and sub-panel frame are made of styrol resin. If you listened to the recent Republican and Democratic Conventions, the noises you heard were picked up on a transmitter like this. **8.** Interior of the above transmitter showing self contained battery power unit and insulation of synthetic resinous materials.

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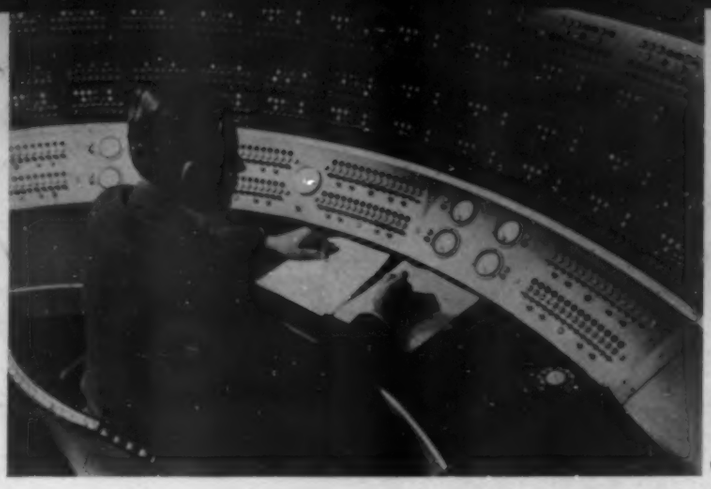

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added to their well-known advantages in electronics, give them a good future sales opportunity in the business of broadcasting."

People like to see behind the scenes, especially the scenes of anything theatrical. Thousands visit the studios and stations of broadcasting companies. Hardly an urban dweller but does so, soon or late. The studio is missing an opportunity if it does not try to impress them with its importance and alertness. Tasteful, lively appearance helps to do it, and "color," as somebody said, "gives life to form." Color suggests cheerfulness, thought, and conscientiousness on the job in hand.

For years it was the custom to build electrical plant equipment in the solemn dignity of black, except where copper showed through. Beauty, especially in color, was too frivolous for electrical science. But recently the designers gave way a few points and sparkled things up a bit with chromium and the like. Now, Western Electric, who make WOR equipment, and others, are favoring color. Mr. Lyon believes the trend will continue, and he *knows* it will, so far as he is concerned. Color will be a major consideration in all his future work, he says. Color in broadcasting interiors can be in many and pleasing combinations; one need not make an unalterable decision on some particular color and stick to it. New color in a plant or studio can be just as refreshing as it is in the home.

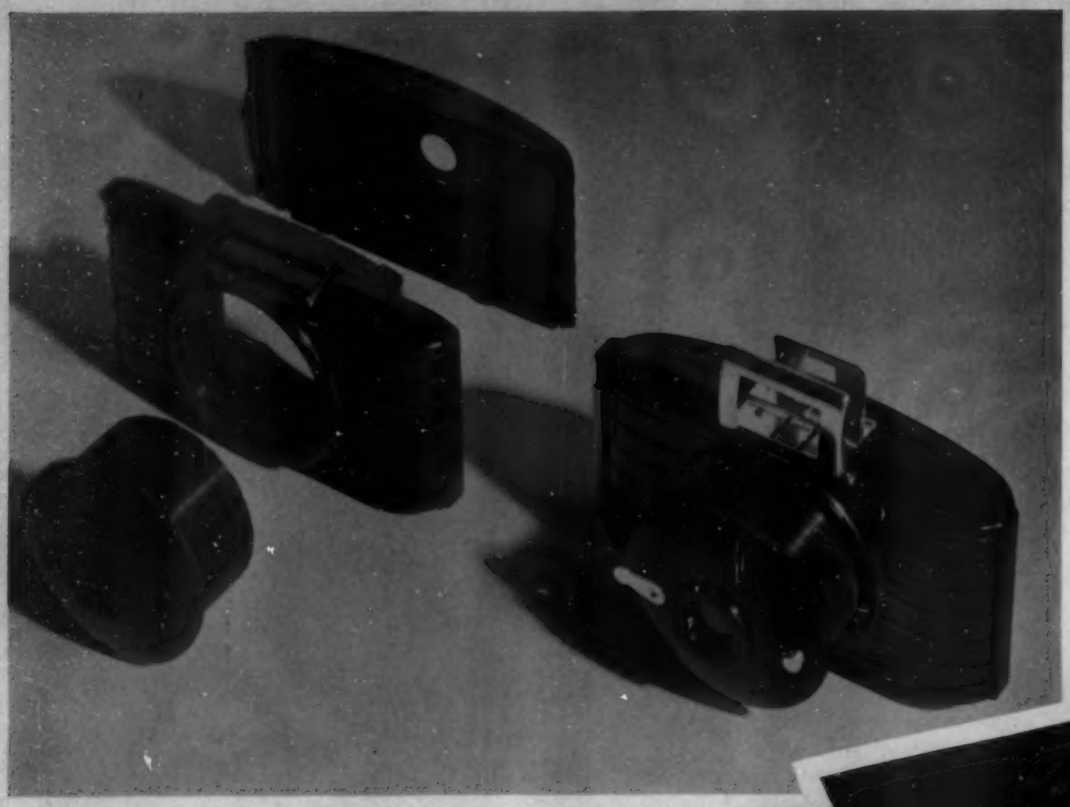
Of course the advantages of color are in addition to the other merits of plastics. Everybody knows their convenient dielectric capacities, their economy, and adaptability. Mr. Lyon says that with sharp tools they get very satisfactory machine finishes in their experimental and some short-production designs. Machinability is a great advantage in broadcasting development work where it would cost too much to make molds for trial parts.

In all broadcasting studios phenolics and ureas are used in electronics for their mechanical advantages. Tube bases, sockets, knobs, and larger units are made of them. These types, too, are suitable as insulation where low frequency fields are involved. The ureas have about the same electrical characteristics as phenolics but they offer a wider choice of color for decorative contrast.

When subjected to high frequency electrostatic activity, most plastics display some power loss. The general nature of this loss can be understood by considering a simple Leyden condenser with two plates of metal carrying opposite charges. These charges constitute a tension which tends to neutralize through discharge. The discharge is resisted by the intervening dielectric plate. Resistance is never 100 per cent. The greater the frequency, the less the resistance and the more the power loss.

The best dielectric known to electronics is fused quartz, which is somewhat similar to glass. Next best for practical purposes, known as "low-loss" plastics, are the meta- or poly-styrol resins which present adequate resistance to high frequency losses. Low moisture absorption contributes to the dielectric merits of styrol resins. In this country, this product is made under the trade name of Victron.

Phonograph records are used extensively in the broadcasting of "electrically transcribed" programs. Some of these records are made of cellulose acetate but those of Vinylite are less (*Continued on page 52*)



Plus or minus zero

BY J. M. FENLIN

SALES ENGINEER, BAKELITE CORPORATION

Eastman Kodak's new Bullet Camera is the last word in precision molding

"WE WANT you to produce a molded camera for us. It must be molded in three parts—a back, a case and a multiple-threaded lens tube. The back and case must fit together so tightly that there will be no light leakage. On the other hand, the parts must not bind at any point, otherwise a special spring mechanism, which we intend to use, will not throw the back open when the camera is unlocked.

"The multiple-threaded lens tube is to have twenty threads 18° apart on the circumference with a .800 in. lead. This tube must have no taper whatsoever. Also, when the tube is 'in,' the two holes for the bulb stop and lens trigger must be absolutely vertical. All parts produced must be interchangeable with one another. This will mean exceptionally close tolerances."

Suppose—just suppose—that a molder had been given these exacting specifications ten, or even five years ago. Most certainly he would have regarded his customer with apprehension and then politely refused to undertake the job. Moldings requiring such precision were out of question. Yet today, those very specifications are being met and one of the finest precision molding jobs is being produced—Eastman Kodak Company's newest camera, the Bullet.

Although many details involved in the production of molded cameras had been worked out in the past few years, a difference in the design and shape of the Bullet model presented a number of new problems in molding technic. No one had ever attempted to mold a multiple-threaded tube requiring such a high degree of accuracy in the threads. These, as well as the other dies, were produced in the molder's own plant.

No taper could be allowed on the tube, because, if it were in the "out" position, it would be loose and would sag enough to throw the lens out of focus. On the other hand, if the small end were tight enough to prevent sagging, the tube would not screw in easily. Also, the two holes for the bulb stop and lens trigger must be in a vertical position *(Continued on page 54)*

PLASTIC MODES

BY EVE MAIN

Sand sprawlers reach a new high in comfortable relaxation protected from blowing sand and glaring sun by one of these Riviera Wind Shelters, made of transparent amber cellulose plastic. It's healthful, too, according to its producer, since the plastic material permits ultra violet rays to filter through, soothing aches and pains and routing stubborn summer colds. The screen is securely taped at the top, with base and side panels of gaily striped or solid-color fabric and a roomy pocket holds magazines, cards and other beach necessaries. The wind shield is light in weight and rolls up so compactly that it may remain in the car or be carried about with ease. (B. M. Hollerith Co.)

ABERCROMBIE & FITCH

DU PONT

Costume jewelry steps out this summer in a galaxy of shapes, sizes and colors well nigh irresistible to L.S.R.* females. (*low sales resistance). Here are a few pieces chosen from here and there worthy of mention. 1. Hinged bracelet, clip and buckle of white cast resin with gold metal strips in center of petal-like motif. 2. Delicately carved hinged bracelet and brooch that come in bright, translucent colors. 3. Gold metal posies bloom radiantly on a black hinged bracelet and two button earrings. 4. A silly little tortoise outlined in gold metal rears its head on a mottled green bracelet and clip. (Cohn & Rosenberger, Inc.) 5. Criss cross lines carved on the underside of transparent cast resin give a linen weave effect. The bowknot design in luscious jeweltone shades appears equally charming with the fluffiest chiffon or severest

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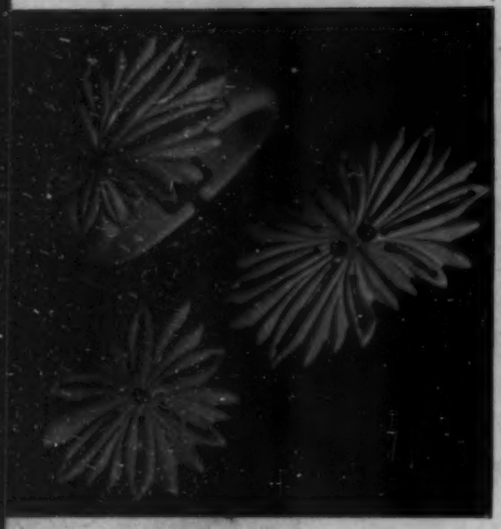

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sport dress. (Cahn & Co.) 6. Boutonniere brooches, pins and bracelets of cellulose acetate in beautiful colors simulating the flowers they represent. Stems and leaves of the same material are sprinkled with rhinestones. (Geo. F. Berkander) 7. Frances Stevens, radio songbird, pins back her modified sombrero with a forbidding six shooter pin in grey cast resin. On her silk scarf she pins a matching miniature ten-gallon Stetson with bright red band. Grand for the duderine rancher or with sport clothes for town and country accessories. (Cahn & Co.)

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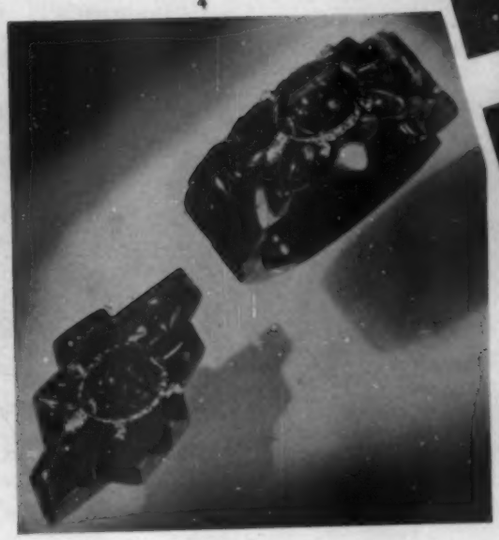

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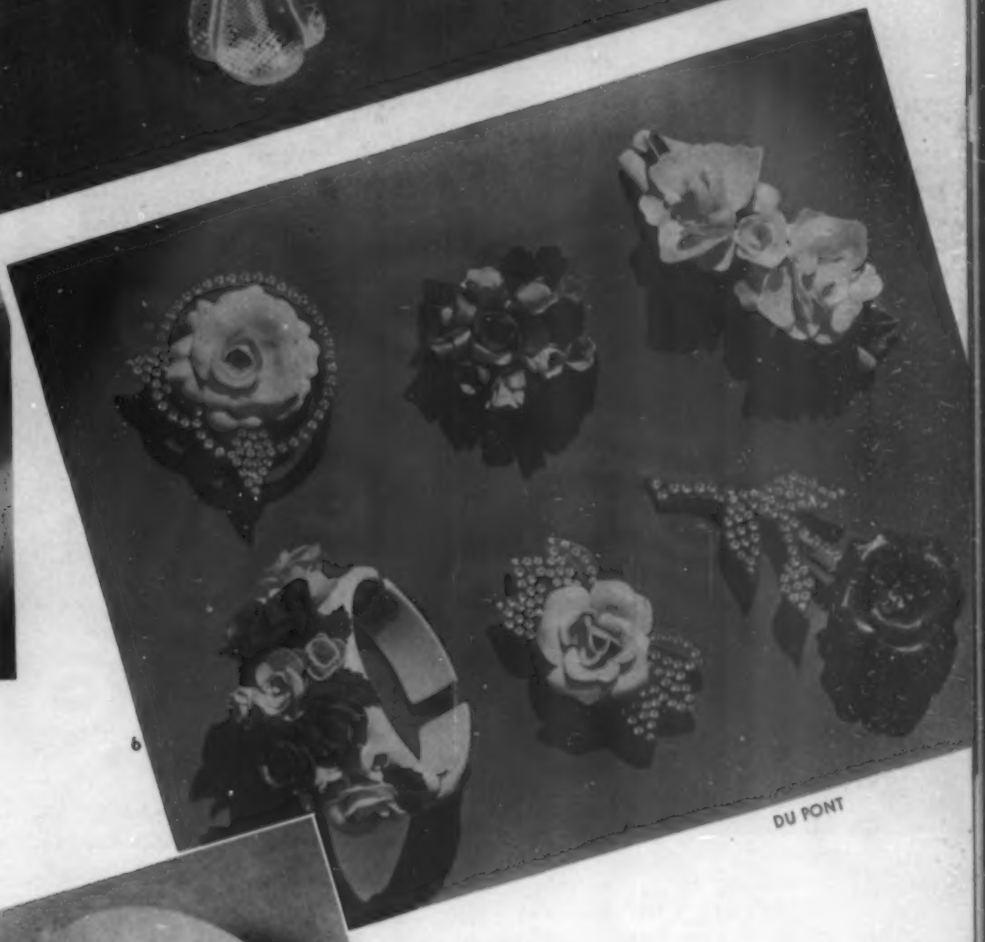

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DU PONT

CATALIN

7

Six feet of summer comfort

The smartest beach sandals are wearing trimmings of cellulose plastic because this material stands the wear and tear of sand and salt air without becoming faded or shabby. 1. This pair of green cork-soled sandals with chunky heels has a strand of yellow plastic material threaded up and down across the toe. 2. Straight from France come these chic white sandals made of narrow strips of white cellulose and string woven together for greater strength and durability. They have leather soles and broad low heels. 3. The T-strap of these brown linen sandals is built of twisted strands of vari-colored plastic, separated at the ankles to pass through two loops for tying. Smartly comfortable for vacationists of all ages.

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McCREERY

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Permanent exhibit

A COLORFUL and educational exhibit of modern plastics showing industrial, ornamental and practical examples of various applications of these versatile materials opened June 15 at our display rooms, 425 Fourth Avenue, New York City. Since the first day visitors representative of all parts of the country have been coming to see the samples entered by leading molders, laminators, fabricators and material suppliers exhibited for the purpose of assisting those within and outside the industry in intelligent development or adoption of plastics for many purposes.

The exhibit cases have become a clearing house for information and assistance to those seeking a greater knowledge of the possibilities of getting a product that has superior properties and at the same time saving expense through using plastics. The display serves as a directory to the proper sources of material supply or to just the right manufacturer with the equipment needed to do a specific job, thus saving the inquirer considerable time and inconvenience occasioned by writing to indefinite sources.

Individual displays are arranged according to the type of article exhibited—for instance, the industrial moldings are grouped together, showing hundreds of interesting parts for automobiles, airplanes, radios and machinery of all kinds. Electrical items are assembled in one section exhibiting switch plates, plug caps, socket holders and miscellaneous fixtures for electrical appliances. All stock molds published in the stock mold pages of MODERN PLASTICS, as well as many parts which will be shown in future issues, are on view and may be examined by those interested in obtaining boxes, containers, knobs, handles, jardinieres, knitting needles, clock cases, electrical parts, closures, or any of the stock items which have appeared in the magazine from time to time.

The brilliance of color afforded by urea plastics is evident in the display of household items, including lamp shades, kitchen utensils of every sort, children's and full-size dishes, and in delicate pastel combinations obtainable for jewelry and for cosmetic containers. Also in the cosmetic case are a number of unusual examples of turned cast resin powder jars in shades to harmonize with the dressing room.

Plastics are used to advantage on the exterior of homes as well as inside and a great deal of interest has been shown in methods of making cold molded, natural grained and colored, weather-proof, fire-proof shingles which eliminate the necessity of painting.

Various miscellaneous items such as cameras molded with fine precision, a Toledo scale housing—one of the most ambitious moldings (*Continued on page 53*)

Shades for the lamps of America

BY R. T. ELLIS

DU PONT VISCOLOID CO.

On the facing page are shown a few of the currently-popular translucent plastic shades, with pleated styles predominating, but their color charm is best revealed when the lamps are aglow

THE latest example of the growing importance of plastics for household furnishings is the appearance of Sundora shades which were exhibited for the first time at the New York Lamp Show.

These shades are made of "Plastacele" cellulose acetate plastic, a material particularly suitable for the purpose, because of its natural luster, its soft diffusion of light and the fact that it can be washed and easily kept clean. It is also claimed to be grease-proof and stain-proof.

When du Pont decided to develop colors for these beautiful shades, considerable study was first made of the color schemes most popular in bedrooms and living-rooms, for the colors of the lamp shades had to blend with the other decorative motifs in these rooms. When this research was completed, the chemists began to prepare "Plastacele" in the hues desired. Particular care was taken to obtain the correct tone effects along with the proper degree of translucency. The result is a gay list that includes Azalea Pink, Ming Gold, Bermuda Peach, Flesh Tone, Aztec Rust, Taffy Beige, Eggshell White, Nile Green, Mosaic Green, Sundust, Bermuda Blue, Springtime Orchid, Granite Mottle, Cloud White and Ariel White.

The variety of styles offered includes stretched types and shades with both narrow and wide pleating. Many unusual decorative treatments are seen. For example, one stretched white shade for a table lamp has an effective scalloped trim of the same plastic in deep pink. Another attractive offering is a stretched shade with a transparent mat finish, enhanced by silver stars and sapphire insets that look like jewels.

Of simpler style is a bridge-lamp shade of white Sundora adorned with diagonal trim of two-toned brown braid. A silvery moiré shade of this material is especially attractive on a lamp with a metal base, or on one of colored glass. Pleasing effects, too, are obtained by manufacturers who have composited a fabric to one side of the sheet stock. Embossed models and others with intricate gold etchings have also been introduced.

A number of pleated styles are decorated with a beaded cord interlaced at the edge; others are trimmed with looped cords and flat flowers. Pleated boudoir shades in soft pastel colors are reported to be the most popular style at the moment. What the future holds forth is anybody's guess, but with a material as well adapted for lamp shades as acetate undoubtedly is, designers may be expected to create new forms and use new colors as fashion may dictate. Meanwhile, current offerings are the vogue.

In addition to being smart and attractive, all the shades mentioned diffuse a soft light that is adequate but at the same time soothing to the eye.

To clean Sundora shades you need only to wipe the ivory-like surface with a damp cloth and the task is done. The fact that this new material will not ravel or lose its color by fading is another very important advantage.

Shades of the kind described are fabricated by several manufacturers, and are on sale at many of the leading department stores and gift shops.

They clean well with a damp cloth and give soft, even light

Better material for better light

Editorial comment

ISN'T it possible that much of the remaining frustration of business may be traced to causes so close to the nose of industry that they remain unseen? Can it be due in part to an inherent resentment to changing conditions and failure to make adjustments to meet things as they are? We are still in the grip of the epoch of machinery while struggling to get on our feet in an epoch of materials. Confusion is the natural result. It is much easier to cry out in despair, blaming first one thing and then another, than it is to get down to earth, analyze the new order of things and make adjustments accordingly.

In spite of mistakes and retrogressions, the past epoch has been one of tremendous progress. The new epoch, which is already well under way, will far outstrip the past in every respect. The machine epoch has taught us that we can make anything we wish to make. The epoch of materials now opens the way to make things better. It is the old, old story of adolescence, growing pains, then maturity. Although this history of growth has repeated itself in different epochs since our country was born, each change is fraught with uncertainties, first alarming, then indicative of the course to pursue. Old ideas, old methods, old habits of thought are not easy to discard. They carry over from one period to another with unvarying results—confusion and delay.

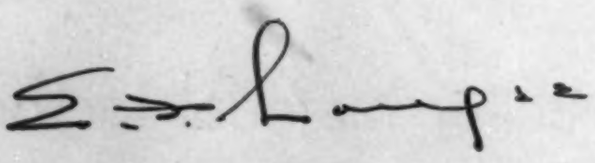
The machine epoch from which we are emerging has left valuable heritages which will persist. There isn't space here to recite more than a few, but electric lights, radio, aircraft and the automobile will serve to establish the fact. With them have come educational advantages, especially to the great rural and small-town population which constitutes the marketplace for a vast portion of manufactured goods. This great population, through its increased ability to travel about in automobiles, its contact with world affairs made possible through radio, and the natural expansion of urban ideas and culture brought about through these contacts, has developed new ideas. It is no longer satisfied with run of the mill merchandise manufacturers used to be able to market in such territories. Retailers have long since learned this to their peril. Those who would succeed with retail distribution must keep in close touch with markets. They must anticipate and appreciate trends in design. They must keep a step ahead of national sources of information which create demands.

SO LONG as industry refuses to recognize these changed conditions, it will continue to suffer. So long as it continues to make old things in the same old ways, it will find a difficult market to conquer. Yet we still see steel expensively grained to imitate wood. Or other metals lacquered to hide their natural beauty and finish. We see plastics, in which homogeneous color and flexibility of application recommend them for better design, used badly. These new materials too often take on old shapes which make them dull and uninviting. This epoch of materials depends largely upon the coordination of art and industry for its growth and success.

Our machine epoch was one of tremendous production. "How many," and not "how well" was the keynote of the times. If the benefits of this experience in production are to be retained in this epoch of materials, the reason why people spend money for the things they want must be considered and understood. The underlying principles which distinguish between buying necessities and luxuries must be reckoned with. One of the outstanding lessons offered studious industry during the last few years, was that industrial design can do as much to influence sales as any other single factor of our merchandising structure. That is why it has become an international topic of conversation among those most interested in the return of prosperity, and among those most determined to do something to hasten that return.

TO POINT out that the lesson has not been universally learned, let me quote a paragraph from a recent issue of *British Plastics:* "In spite of all that has been written about the British Industries Fair, 50 intelligent and well-informed men and women were at a loss to find a sufficient quantity of good examples among the plastic output to date to fill a small section of a unique exhibition which is now to tour the main provincial centers for a year. How are we to account for this? I think the answer lies in a remark made to me by an R.I.B.A. official: 'Sixty molders,' he said, 'quite frankly told us they were *not interested in design.*'"

Has England a monopoly on this industrial lack of interest in design? I'm afraid not. We find an abundance of it right here at home. On the contrary, we find the public is ready for a definite change. It rallies almost instantly to that which is new. This epoch of materials and design presents a new world of opportunity. Will industry soon realize this changed condition and progress! Or, will it continue to be lulled to sleep by its own indifference!



Stock molds

SHEET FIFTEEN

REUSE value is almost as strong a factor in favor of these stock molded boxes as initial utility and manufacturers will find them suitable for a number of purposes because of their diversity in size, shape and design. Those with prints on the covers may also be obtained plain in various color combinations, which gives the opportunity for selection and still avoids costs for an original mold. Please mention sheet and item number when writing.

115. Box with lift-off cover; $11\frac{3}{16}$ in. by $3\frac{7}{16}$ in.; depth $2\frac{3}{16}$ in.; overall height $3\frac{1}{16}$ inches

116. Oblong box with hinged cover and extended base; 6 in. by 3 in.; depth $1\frac{1}{4}$ in.; $2\frac{1}{8}$ in. overall height

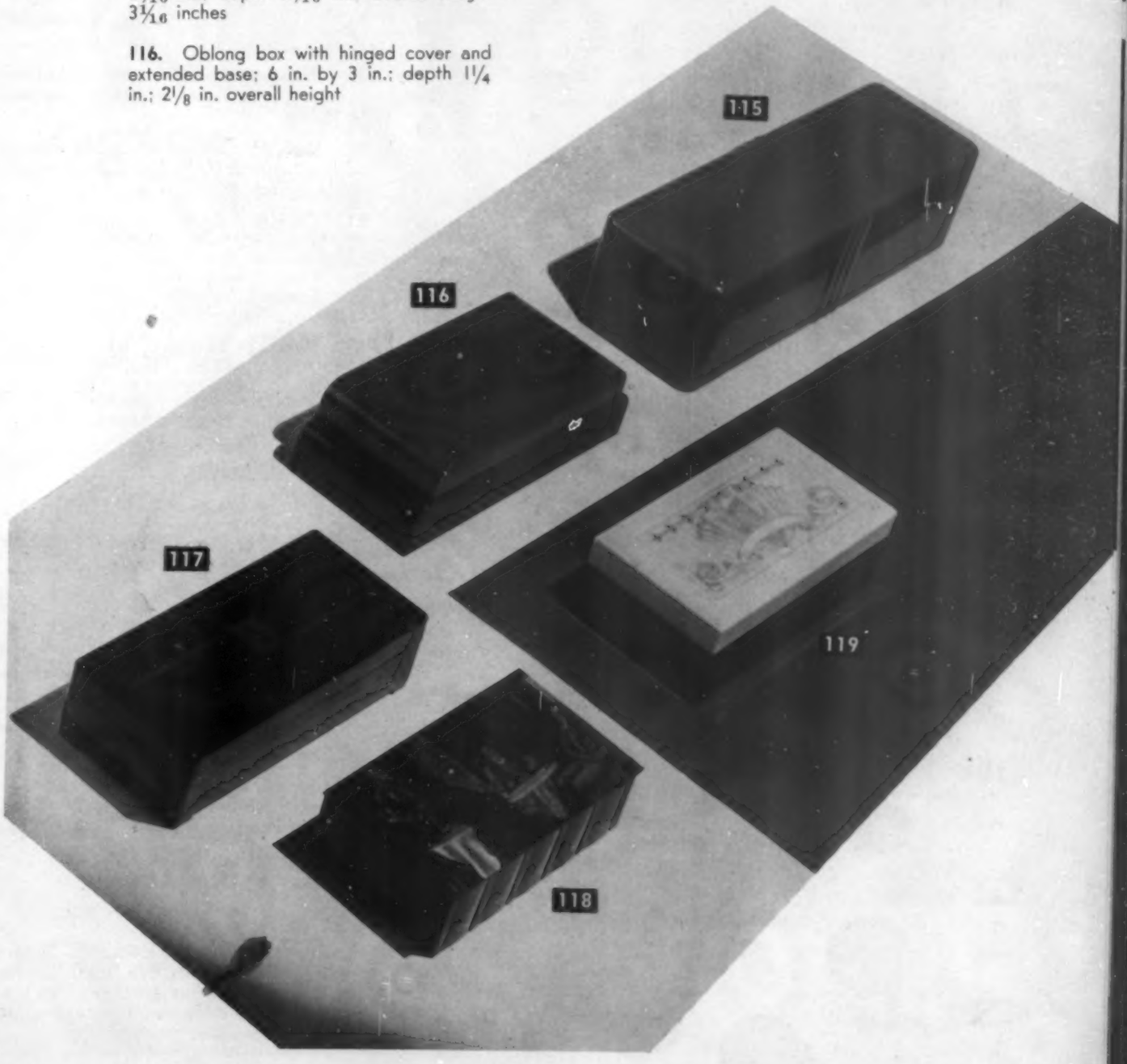
117. Oblong footed box with hinged cover; $6\frac{3}{16}$ in. by 3 in.; depth $1\frac{3}{16}$ in.; overall height $1\frac{7}{8}$ in.; cover is designed

118. The hinged cover on this box is laminated with a colorful print which may be eliminated if desired; $5\frac{1}{16}$ in. by $2\frac{7}{8}$ in. with $1\frac{3}{8}$ in. depth; $1\frac{11}{16}$ in. height

119. Oblong box with hinged cover bearing elaborately carved decoration in a recessed panel; 6 in. by 3 in. with $1\frac{5}{16}$ in. depth inside; $2\frac{3}{16}$ in. overall height

Address all inquiries to Stock Mold Department, Modern Plastics, 425 Fourth Avenue, N. Y. C. All molders are invited to send samples from stock molds to appear on this page as space permits.

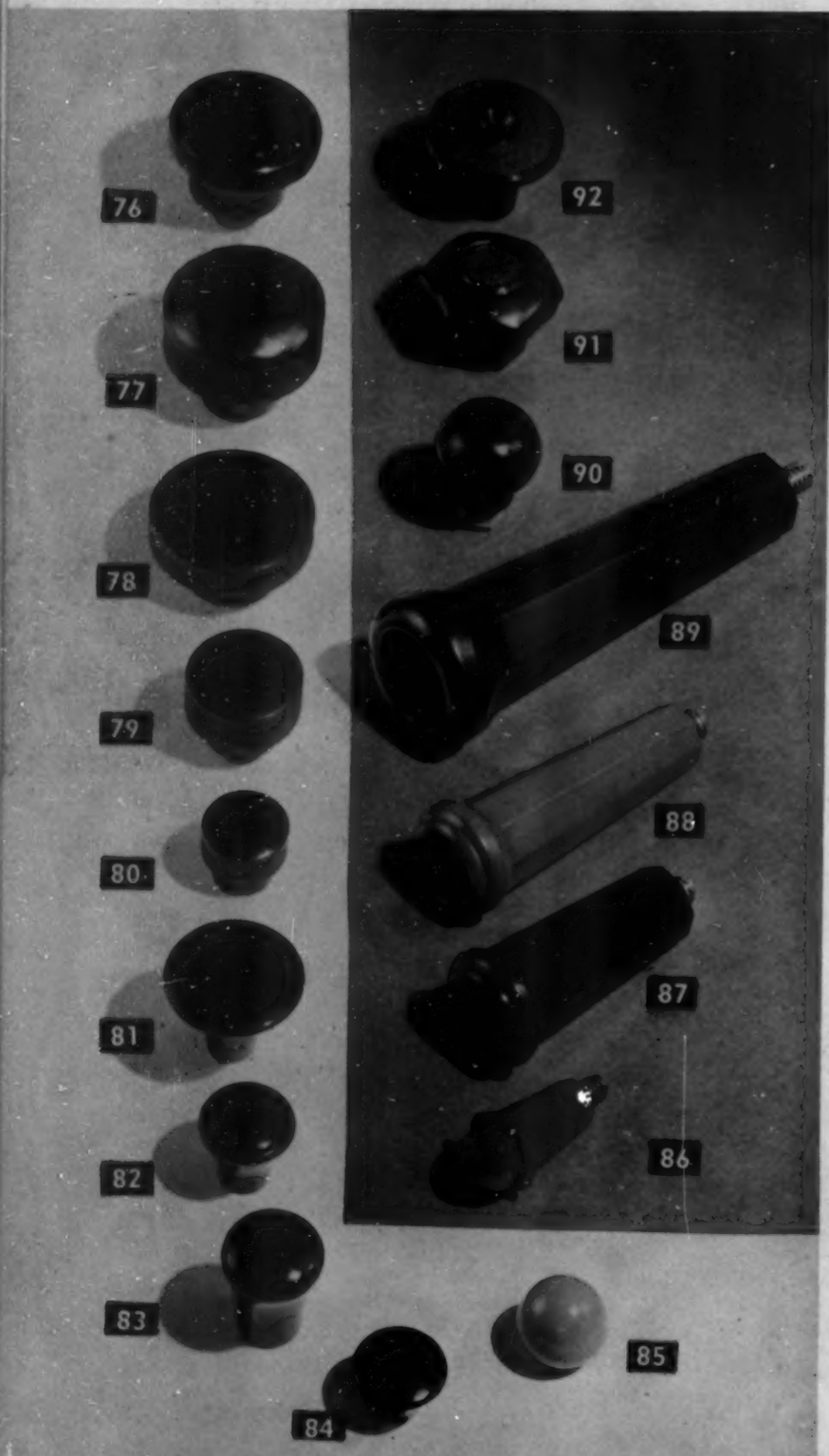
WORTH FILING



Stock molds

SHEET SIXTEEN

WHETHER it's for a stove, radio, automobile or any number of other products, manufacturers will probably be able to find handles of good design adaptable for use from stock molds. Below are a few of the many available.
All items shown on these pages are on exhibition at our newly-opened Plastics Exhibit, 425 Fourth Avenue, New York City. Please mention sheet and item number when inquiring by mail.



76. Knob with circular design; threaded screw-in insertion 3/4 in. high; 1 1/8 in. diameter across top

77. Knob with knurled edges for grip; threaded insert; 1 1/4 in. top diameter

78. Knob 5/8 in. high; knurled edges; threaded insert; 1 1/4 in. top diameter

79. Knob with threaded insert and knurled edges; 7/16 in. high; diameter across top 7/8 inches

80. Knob with knurled edges and threaded insert; about 1/2 in. high; top diameter about 5/8 inches

81. Circular designed top on plain knob; 7/16 in. high; 1 in. top diameter, threaded insert

82. Knob of similar design with threaded insert; 9/16 in. high; 5/8 in. in diameter

83. Plain knob with threaded insert 3/4 in. high; 3/8 in. diameter at bottom

84. Small plain knob, threaded insert; 3/8 in. high; 5/8 in. diameter across top

85. Round knob with threaded insert; 3/16 in. wide; about 5/8 in. high

86. Handle 1 1/8 in. long; threaded extension 1/4 in. long

87. Hollow stove handle 1 7/8 in. long with threaded screw-in insert 3/16 in. long

88. Hollow handle of the same type, 2 5/16 in. long with threaded screw-in insert 1/4 in. long

89. Hollow handle 3 1/2 in. long with threaded screw-in insert 3/8 in. long

90. Plain round knob 3/4 in. long, threaded insert approximately 5/16 in. in diameter

91. Hexagon knob with decorated top; diameter at bottom 9/16 in., threaded screw-in insert 1/8 inches

92. Knob with decorated top 1 in. high, with hole all the way through center for screw and nut

Address all inquiries to Stock Mold Department, Modern Plastics, 425 Fourth Avenue, N. Y. C. All molders are invited to send samples from stock molds to appear on this page as space permits.

WORTH FILING

If we were giving medals . . . we'd pin one on . . .

PRESCOTT HUIDEKOPER

Prescott Huidekoper, president of American insulator Corp., because he has made his plant one of the outstanding in the molding field; because as a young man from Harvard University, his urge to try new things led him into such diversified paths as farming in the hills of West Virginia, commanding a Machine Gun Battalion in France in the World War, back to horticulture after the armistice was signed; because he finally settled on a future in the plastics industry and finds it so fascinating a "game" that he plans to make his efforts for its promotion permanent.

Clinton W. Blount, because after graduating from the Naval Academy he decided he would rather be a radio engineer than an admiral; because after attending Columbia one summer session he followed the advice of his instructors and became a cub salesman with the Radio Corp. of America instead; because his outstanding work there brought him to the Bakelite Corporation in 1924 and where since 1932 he has been assistant sales manager; and finally because he gets fun out of business as well as from hobbies—raising corn and old-fashioned southern yams in New Jersey soil, a hangover perhaps from his early days in Temple, Texas, where he was born.

CLINTON W. BLOUNT

WHITING N. SHEPARD

Whiting N. Shepard of the Plaskon Co. Inc. because his versatility in the plastics industry extends from writing articles on urea and other materials to finding new uses of Plaskon for molder customers, and acting as sales engineer and assistant with advertising under James L. Rodgers, president of the firm; because his knowledge of plastics comes from experience gained by working, after graduation from Williams College, in every department of the factory making urea material, as required of all cubs in this organization; because his enthusiasm for plastics has become as contagious as was his enthusiasm for golf which he says was his "major" in his college years.

PLASTICS' PROGRESS

1

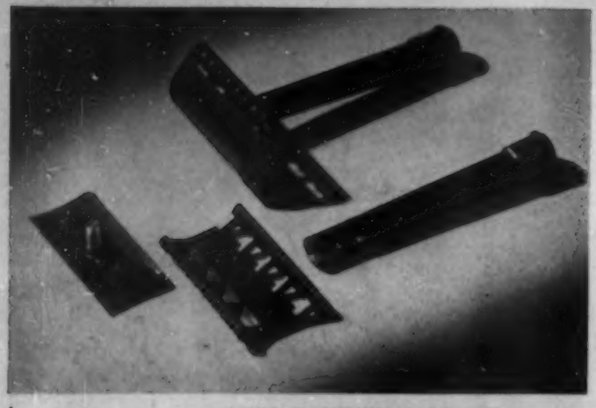
2

3

1. John Werthemier of the Minimax Co. is responsible for the design of this dual-use Bakelite tumbler in which the Minimax Co. packs twenty-five cartridges of local anesthetic for dentists. The tumbler has a metal cap and so far as we know is the first plastic container to be vacuumized. Molded by Harry Davies Company.

2. Those looking for premium items offering maximum utility will be interested in Schieffelin & Co.'s use of plastics for their two-in-one coaster tray. It is a combination ash receiver and cocktail tray produced in fire-resisting, mahogany-finish Bakelite. Space for an advertising message is provided at the bottom. Designed by Reliance Advertising Company and molded by Northern Industrial Chemical Company.

3. A twist of a small crank on this new soap pulverizer converts a cake of soap contained within a molded Textolite housing into pulverized form and feeds it into the hands of the user. A fresh cake of soap can be easily inserted since the entire front of the dispenser may be removed



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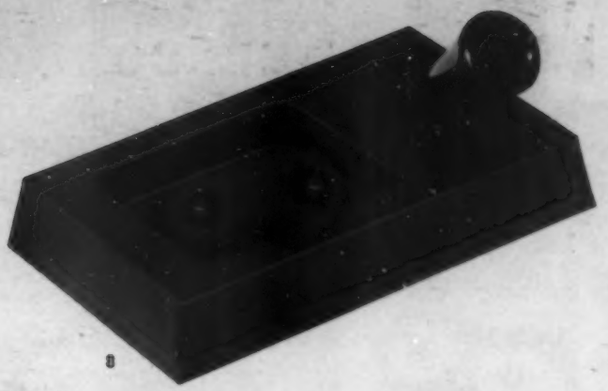

8

for reloading. The plastic housing eliminates any possibility of corrosion and provides a permanent finish easy to maintain. Manufactured by Voorhis-Tiebout Co., Inc.

4. These are the nearest to being an all-plastics unit of any razors so far on the market, according to the Watertown Mfg. Co., molders of the Neillite safety razors in the picture. The only two metal parts on the entire device are integrally molded as inserts, the three simple parts are easily dissembled and assembled for reinsertion of blades and cleaning. Molded for American Merchandise Co.

5. Heat-O-Matic and Speed-O-Matic, General Electric Co.'s two new fully automatic Hotpoint irons are semi-streamlined in design with thumb rests and control dials for regulating the degree of temperature needed for ironing various kinds of fabrics. The handle and heat control knob of the Heat-O-Matic are black Textolite; on the Speed-O-Matic, tudor walnut-finish Textolite is used.

6. A powder whisking brush to give a finished appearance to make-up is rapidly becoming an indispensable item in feminine toilette equipment. The one illustrated is the latest development of the Prophy-lac-tic Brush Co., and has two rows of fine, silky goat's hair bristles held firmly in plastic backs of either jade, yellow, red, blue or rose. Molded of Fiberloid.

7. Marschall Dairy Laboratory provides its rennet extract to cheese-makers in five, ten and twenty-four gallon kegs. Each keg is fitted with a Bakelite molded easy flow spigot which is inserted by prying off a metal cover. The handle of the spigot serves as the faucet and operates with a forward motion which opens the closure and permits even the last drop of contents to flow out.

8. Carter's Ink Co.'s cube stand is a combination inkstand and pen receiver of black molded plastic constructed to fit any pen. Rubber feet on each corner of the stand prevent scratching of desks and avoid skidding. It is a compact unit popular because of its convenience and double-service utility. Molded by Colt's Patent Firearms Manufacturing Co.

9. Colorful belt buckles and buttons in the new two-toned Bakelite cast resinoids are available in effective combinations of white and a variety of pastel shades. They provide smart trimming for summer frocks, harmonizing or contrasting with the many interesting shades fashionable this season. Colors

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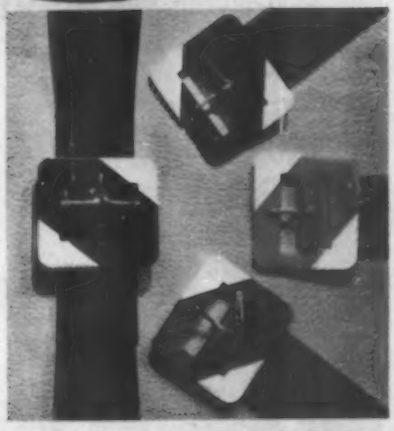

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are deep and rich as well as slightly translucent. Manufactured by Eureka Pearl Works, Inc.

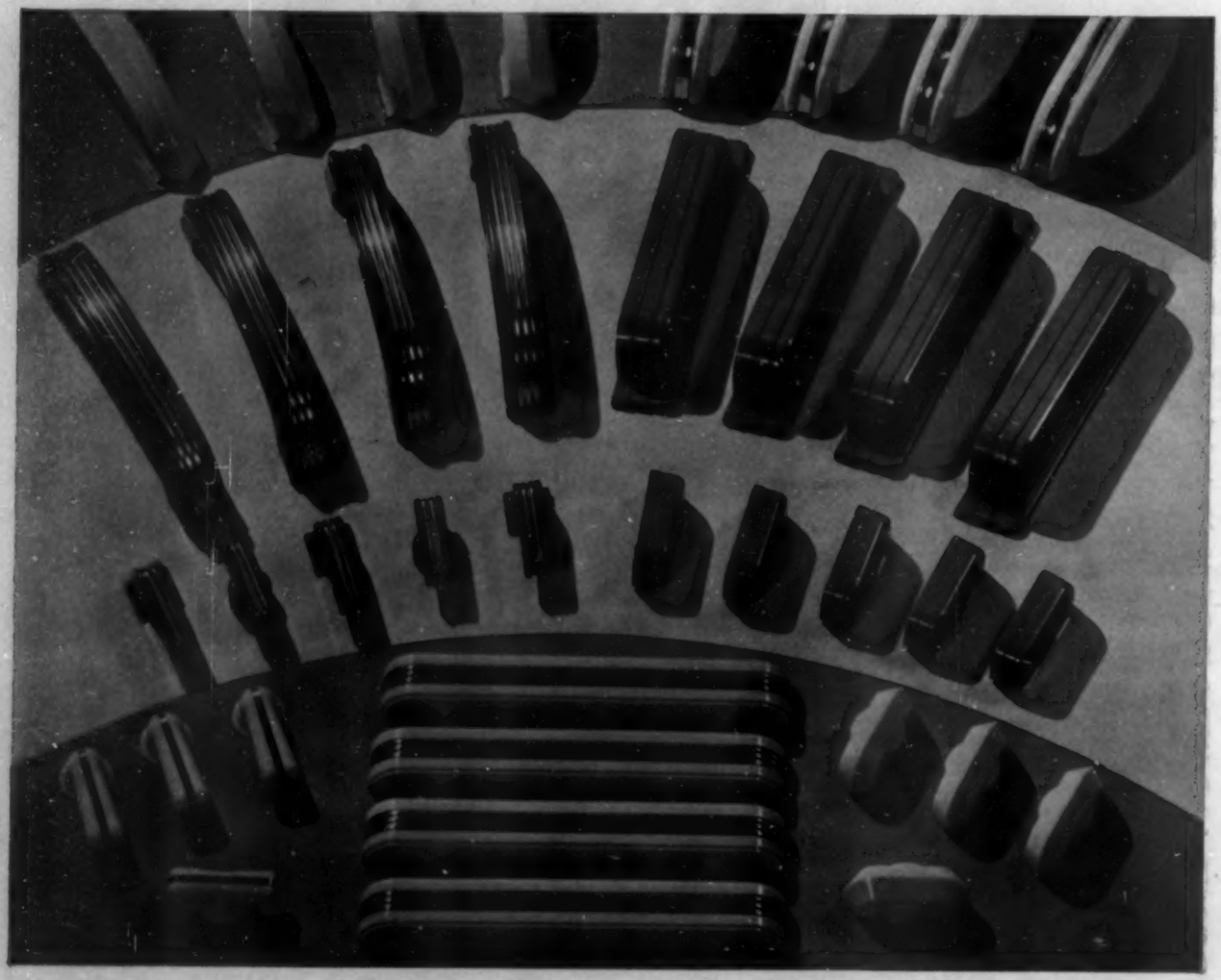
10 Park and Tilford depend entirely upon package appearance and prestige to sell their perfumes in the chain stores. Bottles and labels are designed to this end and molded closures like the one illustrated add visible as well as practical value. The closure has a molded tip inside which fits tightly into the neck of the bottle to prevent evaporation.

PLASKON MOLDED COLOR

STOVE FITTINGS:

The inevitable rise in stove range sales following their adoption; their inability to conduct heat, and their excellent dielectric properties are the stove industry's unromantic reasons for preferring Plaskon fittings. The romantic reason is that Plaskon fittings (like these molded by American Insulator Company of New Freedom, Pennsylvania) please Mrs. June Bride no end. She likes their beautiful colors that match her bright new kitchen harmony, and lend sparkle to a prosaic fixture. Nor is Mrs. June Bride the exception. Cold figures show that women select certain ranges, more often than not, because lustrous Plaskon fittings are available in just the colors they have in mind when they say "I'd like to see your stoves."

These fittings are used, variously, by Odin Stove Co., Estate Stove Co., Detroit Stove Co. and Cleveland Cooperative Stove Co. One is a stock mold.



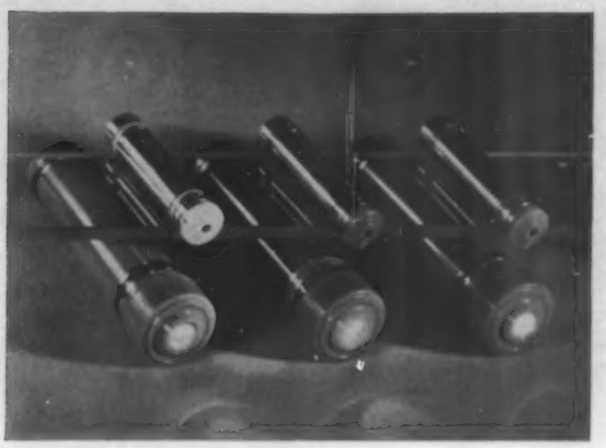
JULY • 1936

PEN AND INKWELL:

Letter writers' enthusiasm for the Swanwell Automatic Inkwell is due to economical efficiency. In turn, this is chiefly due to its ingenious operating principle, which is this:

A molded ink bottle hangs inverted from the top cover. The mouth of this bottle is closed by a patented screw-cap which automatically controls the ink level in the ink dipping reservoir. A valve prevents leakage when the bottle is lifted out of the base. A smooth-writing Swanwell Pen—filled with your favorite ink and ready to spell—completes the attractive and useful ensemble.

The entire body, including the side walls and ink reservoir, is a single piece molding of colorful Plaskon. Beside bearing witness to the molder's skill, the body, with its variation in thicknesses of parts, is another example of Plaskon's "moldability." The set is produced in solid Plaskon color in Ivory, Coral, Yellow, Blue and Green. The Paulis Staples Company, Los Angeles, is the molder.



FLASH LIGHTS:

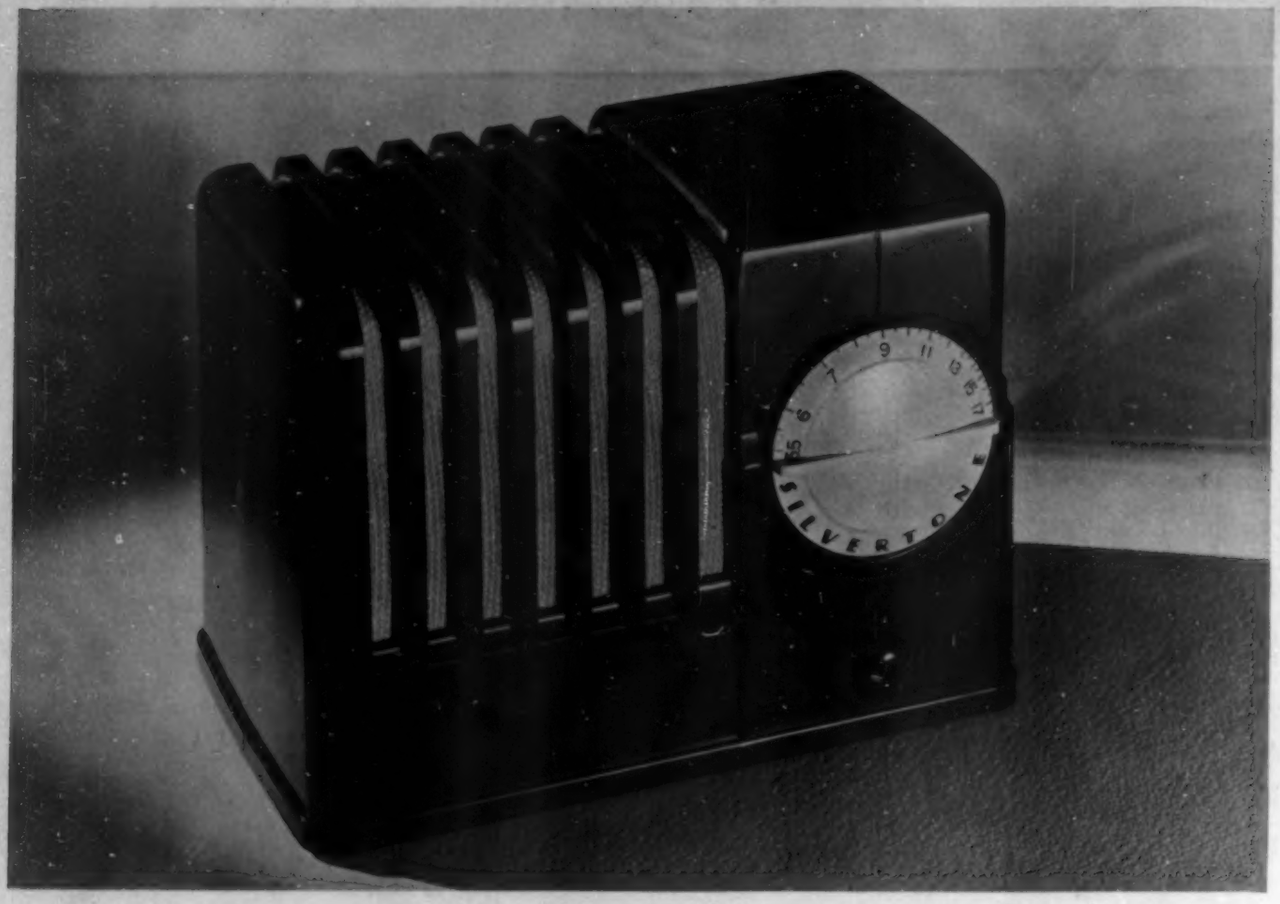
No jewel thieves, we hope, were among the 800,000 purchasers of the small size Usona flashlights that have been snapped up since last September. But it certainly is a possibility because the colorful, translucent, non-corroding Plaskon heads are enjoying universal popularity as a flashlight novelty. In fact, their showing has been so encouraging that the Usona Company last month introduced a larger size.

Molded by the Owens Illinois Closure Company, of Toledo, Ohio.

Lighting Note

Plaskon Company, Inc., wishes to announce that Plaskon has been approved for both the 8" and the 9⅜" reflector-diffusor bowls for I. E. S. Certified Lamps, according to tests made by the Electrical Testing Laboratories.

For complete information concerning Plaskon's wide application in the lighting field, address: Plaskon Company, 2121 Sylvan Ave., Toledo, Ohio.



Sears Roebuck okays plastic radios

BY FRANKLIN E. BRILL

GENERAL PLASTICS INC.

THIS month, Sears Roebuck—one of the world's largest retailers—has put its official stamp of approval on plastics for radio cabinets. They've introduced a new Silvertone Compact housed in a molded phenolic cabinet of excellent design, definitely answering the old question of whether plastics have general consumer acceptance in radio cabinet form.

Three years ago, the question of wood versus plastics in radio cabinets was in about the same stage that wood versus metal now finds itself in the chair-manufacturing industry. Three years ago plastics were recognized as an ideal radio cabinet material, but the question was whether people liked their radios slick and shiny, or soft and textury. In 1933 practically all of the plastic radio cabinets had been originally designed for wood and were fairly impractical in design for moldings, and the main reasons for the use of plastics were price fluctuations in cabinet-work. Furthermore, few manufacturers could plan far enough ahead to build large molds and take advantage of the lower price thus obtainable. Also there was no investment required with wood cabinets. If the public didn't like one designer's version of "transitional modern" they could file it away and start fresh with no dies to write off.

Now that the Modernistic versus Gothic question has been definitely settled and cabinet design has stabilized into a clean, but not stark-looking, modern technique, plastic materials come into their own in radio cabinet work. There is no question but that sensible modern is coming in with a rush. Modern living room furniture is booming, and modern couches, tables, lamps, entire bedroom suites, some good, some fair, can be found in the homes of farmers and laborers, as well as of those in the upper brackets.

Radio manufacturers no longer have to hesitate about the design and materials question. They can get a good, clean design done especially for plastics, and invest in multiple-cavity tools without danger, thus reducing the cost of the molded cabinet—and of course the complete set—and making the sales success of the number even more certain.

That is exactly what Sears Roebuck has done. A glance at the accompanying (*Continued on page 54*)

Production and sales of synthetic organic chemicals in the United States, 1935

The Tariff Commission recently released preliminary figures on the production and sales of synthetic organic chemicals, including dyes, for the year 1935. These show large increases in output of practically all groups of products. The following excerpts taken from the preliminary report indicate very definitely the growing trends of the industry and are worthy of serious study and assimilation.

SYNTHETIC resin, the production of which exceeded 100,000,000 pounds for the first time, reflected the activity in this rapidly developing class of products; resins from tar acids (phenol, cresols, and xylenols) increased to 54,357,000 pounds, or 34 percent more than in 1934; alkyd resins, principally those from phthalic anhydride, increased to 34,123,000 pounds, or by 124 percent.

Of the total synthetic resins of coal-tar origin produced in 1935, about 53 percent was consumed in the manufacture of paints, varnishes, and lacquers and 21 percent in moulded articles. About two-thirds of the consumption in paints, varnishes, and lacquers consisted of alkyd resins, and one-third of tar-acid resins.

Among the individual resins, those made from urea increased 21 percent in production, 29 percent in sales volume, and 41 percent in sales value. Urea, in previous years all imported, was produced domestically in commercial quantities for the first time in 1935.

TABLE 1.—Comparison of United States production and sales of dyes and other synthetic organic chemicals, 1925-30, 1934, and 1935

	1925-30 average	1934	1935	Increase 1935 over 1934
Coal-tar chemicals				
Intermediates:				*Percent*
Production ..... Thousands of pounds	267,492	388,872	436,811	12.3
Sales ..... Thousands of pounds	109,133	161,845	191,055	18.0
Sales value ..... Thousands of dollars	22,408	21,914	26,114	19.2
Finished coal-tar products:[1]/				
Production ..... Thousands of pounds	138,078	[2]/ 205,838	[2]/ 270,835	31.6
Sales ..... Thousands of pounds	133,964	[2]/ 180,451	[2]/ 228,798	26.8
Sales value ..... Thousands of dollars	65,027	[2]/ 81,333	[2]/ 98,087	20.6
Dyes—				
Production ..... Thousands of pounds	94,003	87,178	101,817	16.8
Sales ..... Thousands of pounds	92,207	84,309	97,826	16.0
Sales value ..... Thousands of dollars	39,428	43,251	51,405	18.9
Medicinals—				
Production ..... Thousands of pounds	4,508	10,024	10,023	—
Sales ..... Thousands of pounds	4,106	8,224	8,950	8.8
Sales value ..... Thousands of dollars	7,464	7,921	8,372	5.7
Flavors and perfume materials—				
Production ..... Thousands of pounds	3,966	4,168	4,364	4.7
Sales ..... Thousands of pounds	3,919	3,695	4,080	10.4
Sales value ..... Thousands of dollars	2,901	3,028	3,171	4.7
Coal-tar resins (1927-30)—				
Production ..... Thousands of pounds	24,442	[2]/ 56,059	[2]/ 89,473	59.6
Sales ..... Thousands of pounds	22,135	[2]/ 43,351	[2]/ 64,641	49.1
Sales value ..... Thousands of dollars	7,756	[2]/ 10,127	[2]/ 12,191	20.4
Synthetic non-coal-tar chemicals:				
Production ..... Thousands of pounds	379,972	1,133,719	1,591,106	40.3
Sales ..... Thousands of pounds	264,006	639,410	790,995	23.7
Sales value ..... Thousands of dollars	44,499	72,878	86,053	18.1

1/ Includes color lakes, photographic chemicals and miscellaneous coal-tar products not shown separately.
2/ Does not include coumarone and indene resins.

TABLE 4.—United States production and sales of certain synthetic coal-tar resins[1]/, 1935

Name of product	Total production	Sales		
		Quantity	Value	Unit value
	Pounds	*Pounds*		
Total [2]/	89,473,000	64,641,000	$12,191,000	$0.19
Derived from phenol	35,257,000	33,666,000	6,154,000	.18
Derived from phenol and/or creosols	10,418,000			
Derived from phthalic anhydride	34,123,000	15,648,000	3,440,000	.22
Derived from cresols or cresylic acid	5,990,000			
Derived from xylenols	246,000	235,000	37,000	.16
Derived from:				
Maleic acid				
Sulfonamides (Santolites)	3,439,000	2,957,000	398,000	.13
Styrol				
Xylenols and cresols				

1/For synthetic resins of non-coal-tar origin, see table 6.
2/ Does not include resins derived from coumarone and indene.

TABLE 6.—United States production and sales of certain synthetic organic chemicals of non-coal-tar origin, 1935

B. Synthetic resins of non-coal-tar origin

Derived from:				
Acrylic acid, Adipic acid, Terpenes	18,000	12,000	8,000	.67
Derived from urea	4,203,000	4,005,000	1,829,000	.46

Cellulose plastic products

NITRO-CELLULOSE AND CELLULOSE ACETATE SHEETS, RODS AND TUBES

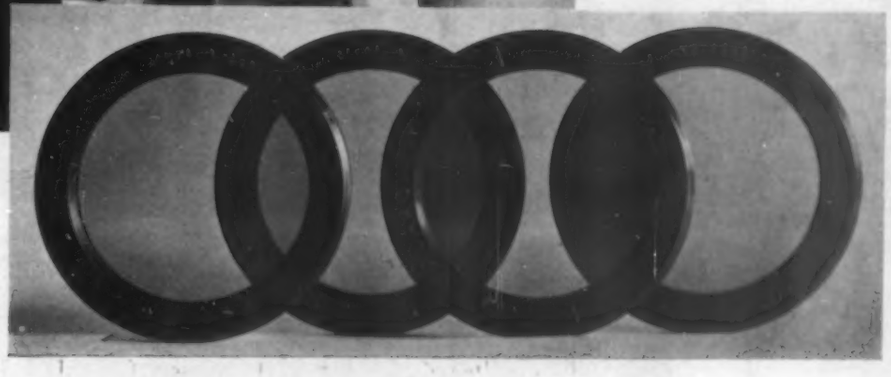
Monthly statistics on production, shipments, and consumption in reporting company plants of cellulose plastic products (sheets, rods, and tubes) released by Director William L. Austin, Bureau of the Census, Department of Commerce. The data were compiled from the reports of 10 manufacturers for January to May, 1935, and of 11 manufacturers for June to December, 1935.

PRODUCTION, SHIPMENTS, AND CONSUMPTION IN REPORTING COMPANY PLANTS (POUNDS)

Year and Month	Nitro-Cellulose			Cellulose Acetate		
	Sheets, Rods, Tubes		Consumed in reporting company plants	Sheets, Rods, Tubes		Consumed in reporting company plants
	Production	Shipments[1]		Production	Shipments[1]	
1935						
January	1,464,819	1,275,172	246,758	1,003,927	1,026,082	10,850
February	1,475,840	1,134,737	231,317	921,644	849,027	10,629
March	1,362,957	1,228,161	230,107	961,900	1,054,411	25,463
April	1,311,038	1,355,838	307,940	1,106,845	1,047,808	33,438
May	1,292,273	1,246,174	237,532	717,934	649,450	18,292
June	1,008,859	1,016,835	225,496	316,930	292,879	15,918
July	1,025,615	1,023,669	231,227	485,652	524,740	14,374
August	2,285,091	1,293,773	300,091	595,440	577,630	13,236
September	1,551,207	1,435,147	332,176	881,702	883,782	22,817
October	1,660,412	1,597,945	372,552	1,299,228	1,238,731	29,577
November	1,297,923	1,420,462	234,919	1,264,664	1,113,645	9,344
December	1,469,379	1,397,809	231,785	948,137	859,457	23,830
Total (Year)	16,205,413	15,425,722	3,181,900	10,504,003	10,117,642	227,768

1/Includes consumption in reporting company plants.
Reg. 29961.

Light–polarizing glass



Edwin H. Land, (at left), inventor of Polaroid, the new material which polarizes light, demonstrates how two discs of the material, each perfectly transparent, can be placed one over the other and turned to such an angle that all of the light is cut off. Any degree of light intensity can be obtained simply by placing one Polaroid disc over another and turning it to the proper angle as shown below. Rims which hold the Polaroid discs in the accompanying illustrations are molded of black Tenite by Northern Industrial Chemical Company

A LAMINATED glass product which greatly resembles ordinary safety glass in construction and has the property of polarizing light has recently become commercially available under the trade name "Polaroid". The polarizing action is obtained by embedding in the plastic layer doubly-refracting crystals of a synthetic organic compound, herapathite, which is a sulphate of iodoquinine.

One important application of this material, which was invented by Edwin H. Land (U. S. Patents 1,918,848; 1,989,371; 1,951,664; 1,956,876; and 2,011,553), is in the photoelastic stress analysis of engineering structures using transparent plastic models. A description of this method, together with a review of fundamental principles of polarized light, is presented in an article on page 36, this issue. Other applications for the product include the removal of glare from automobile headlights, commercial projection of life-like, three-dimensional movies, colorless sun glasses, and improved illumination for oil paintings.

A well-known phenomenon of crystal optics is utilized to polarize the light. Nearly all natural crystals are doubly-refracting, that is they convert an incident ray of ordinary light, having its vibrations in all directions, into two plane-polarized beams moving at different velocities and in slightly different directions. To obtain light polarized in one plane only, it is necessary to remove one of the beams. In the Nicol prism, ordinarily used in polarizing instruments, this is accomplished by total reflection of one of the beams from a film of Canada balsam. However, some crystals effect its removal by themselves because they naturally absorb one of the rays. Herapathite, which is of this latter type, absorbs virtually all the visible light in one of its plane polarized components and transmits a large proportion of the other component. Iceland spar (Nicol prism), tourmaline, and other polarizing crystals which have been used in scientific instruments are expensive and limited in size. The new synthetic product is expected to result (*Continued on page 59*)

Photoelastic analysis of stresses with plastic models

BY ARSHAG G. SOLAKIAN*

The first of two articles in which stress analysis through the use of plastic models is outlined and discussed. The second article which will appear in August outlines the material requirements for this interesting and important work

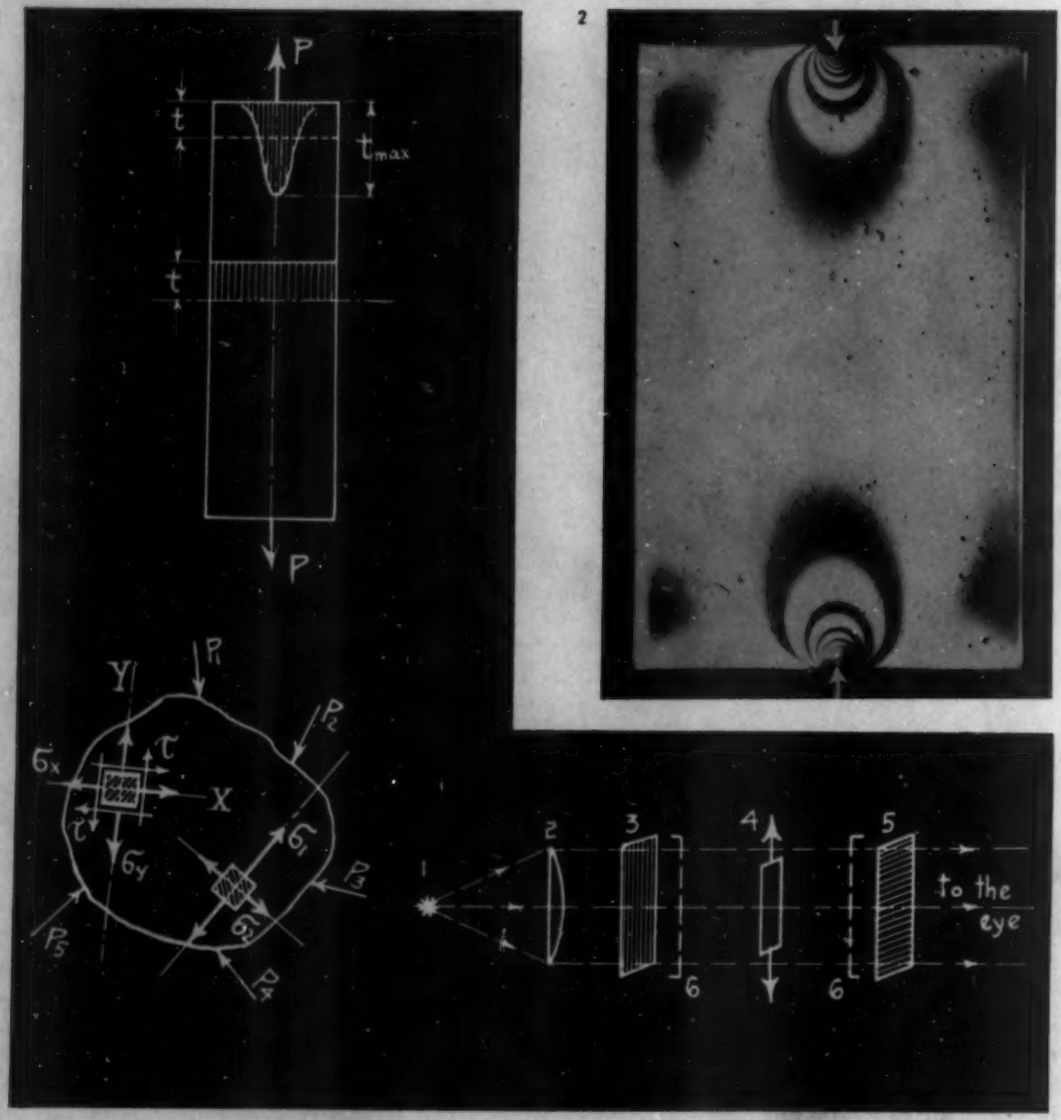


Fig. 1. Stress distribution in a plate under tension. Fig. 2. Stress pattern for a plate under compression. Fig. 3. A plate under several forces. Fig. 4. Outline of polariscope—1) Light source, 2) Condenser, 3) Polarizer, 4) Test piece. 5) Analyzer, 6) ¼ wave plates

FOR the exact design of machines or structures subject to external loads, it is of great importance to the engineer to know the *intensities* and *directions* of the stresses produced in the parts to be designed. With our present knowledge of the theory of elasticity, we are able to get an accurate analytical solution of only a limited number of stress problems of the most elementary nature. Even then the solutions involve higher mathematics and are so complicated that the engineer does not usually find it advantageous to go through such laborious calculations. Consequently the majority of design problems are still solved by indirect methods, empirical formulas, or by mere rule of thumb. In such cases the machines or structures may be either too weak to withstand safely the forces for

* Lecturer in Civil Engineering, Columbia University.

which they were designed, or much stronger than is required. The former condition may cause a premature failure, while the latter means an unnecessary waste of material.

When the design is to be based on laboratory tests, it is necessary to make a small model, usually of the same material to be used for the prototype. The model is then tested under conditions of loading (tension, compression, bending, or any possible combinations) similar to those to which the prototype will be subjected, and the results obtained on the model are then used in proportioning the prototype. Such experimentation is expensive and also the stress distribution is practically unknown. An optical method known as *stress analysis* by *photoelasticity*, which is both simple and accurate, enables the engineer to get a picture of the stress distribution from a transparent model in the form of a pattern of interference fringes. This method makes possible the solution of many two-dimensional stress problems beyond mathematical analysis.

Stress analysis by photoelasticity is based on the theory of elasticity and the optics of polarized light. A brief description of the important principles involved in these subjects should be of interest to those in the plastics industry, not only because their products are used for the construction of the transparent models, but also because this method is applicable to the detection of strains left in transparent plastics during molding or casting operations.

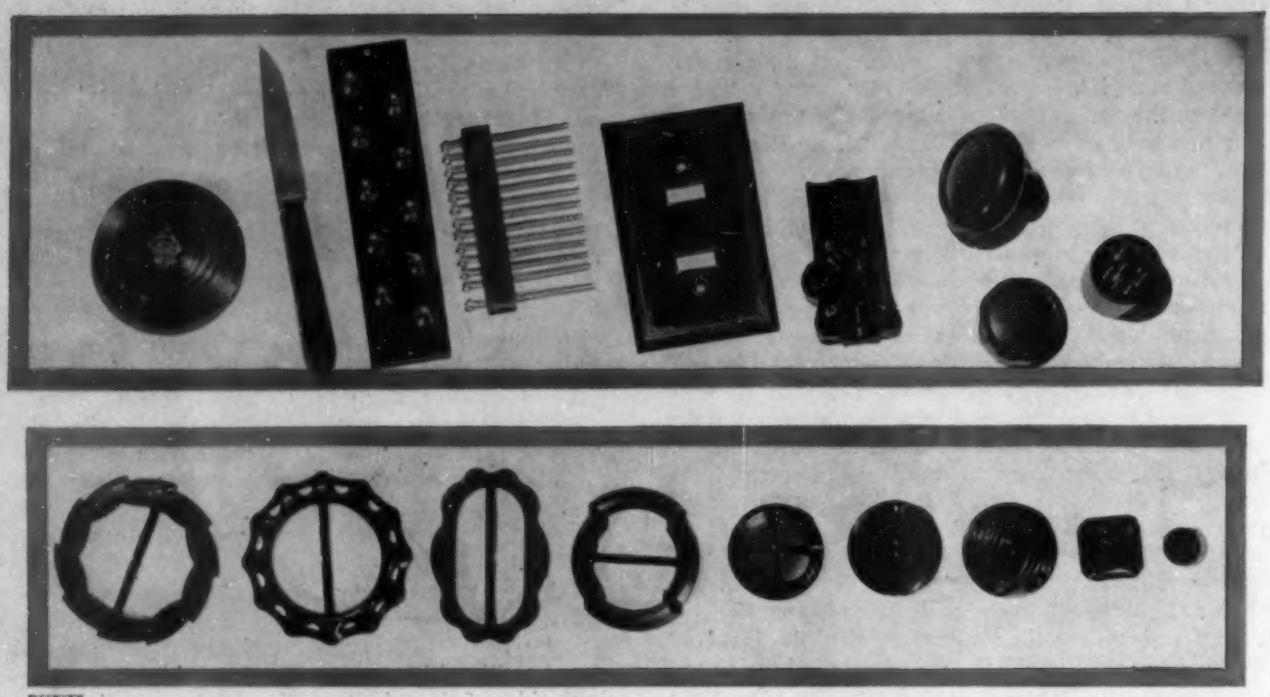
Elements of elasticity

Three universal laws governing the relationship of forces and motions in material bodies were stated by Newton in the 17th century. One of these laws which forms the foundation of our present knowledge of stresses, is that "to each action there is an equal and opposite reaction." Putting this into engineering form, it means that if an external *force* (P) of 1500 pounds is applied as tension at the extremities of a steel plate (see Fig. 1) having a cross section 0.25 x 2 in. and a length of 10 in., then there will be an equal and opposite "reaction" from the plate amounting to 1500 pounds total, which will produce within the plate a *stress* (t) of 1500/ (0.25 x 2) = 3000 pounds per square inch. Also, as a result of the longitudinal tension in the piece, the original length of the plate will increase to something larger, say 10.001 in., thus producing a unit elongation or a *strain* of 0.001/10 = 1/10,000. If the stress is kept below the elastic limit of the material, then the ratio of stress to strain, namely 3000/0.0001 = 30,000,000 lbs. per sq. in., is called the *modulus of elasticity* of the material. The width and thickness of the plate will also decrease at the same time as the length increases, but at a lesser rate. The ratio of these lateral strains to the longitudinal strain is known as *Poisson's ratio*.

All the above calculations would be correct if the stress or strain were of uniform magnitude throughout the entire surface of the plate tested. In actual practice this will be true only for a limited region on both sides of the middle section of the test piece considered. Near the extremities, where the direct effect of the applied load is evident, the stress variation across a cross section is of non-uniform character, as seen in Figs. 1 and 2. It is of larger intensity right under the load than at points near the vertical edges of the plate, judging from the relatively higher order of the stress fringes towards the point of application of the load as will be explained later. The ratio of the highest stress t max. to the average stress t across a section is called *stress concentration factor* due to the localized force P. Similarly, such factors of various magnitudes are produced by notches, fillets of various sizes, cracks and other types of discontinuities. The exact values of these factors are of great importance in the design of machines and structures for reasons described previously. Unfortunately, in the past and even now in ordinary design the effect of these stress concentration factors is ignored entirely, and only the *average stresses* obtained by dividing the total force by the net sectional area are considered. As a result of this practice, especially in the case of structures under the effect of stresses of rapidly changing character due to vibration, etc., unexpected failures usually take place, in spite of the ample allowance made in design by the use of moderately high factors of safety.

Now generalizing the problem, let us consider a plate acted upon by a system of co-planar forces in equilibrium, such as P1, P2, P3, etc., as in Fig. 3. Under these circumstances, the forces on a square element of area can be resolved into the normal stresses Sx and Sy where the x and y axes are parallel respectively to two adjacent sides of the elementary area, and a system of shear stresses t as shown. If we now assume at this point another orientation to the x-y axes, then the values of the normal and the shear stresses also will differ from the previous values. However, there will be found one and only one special orientation of the coordinate axes, corresponding to which Sx will have a (*Continued on page 60*)

5 Fig. 5. Isoclinics for a circular disk under concentrated load



DURITE

This diversity of small objects illustrates the range of molding possibilities with furfural plastics

Furfural in plastics[1]

BY FREDUS N. PETERS, JR.
THE QUAKER OATS COMPANY, CHICAGO, ILL.

THE three largest cereal crops of this country are oats, wheat and corn. The interest of the industrial chemist in these starts at the point where immense quantities of them are concentrated at a manufacturing plant. Wheat and corn are collected in large quantities only in the form of grain. The wheat chaff and the corn cob are generally left on the farm, but oats on the other hand come to the mill with the groat, which is the name for the oat grain, firmly encrusted in a hull. Thus it is, that most of the machinery in an oat mill is engaged in the task of separating the hull from the groat. Once a perfectly clean groat is obtained it is relatively easy to convert it into the form of an edible cereal. In the oat industry therefore the industrial chemist has at his disposal large volumes of two distinctly different types of products—a cereal and a cellulose-pentosan complex in the form of a hull. Two hundred pounds of furfuraldehyde can be made from each ton of oat hulls.

Furfural has been commercially produced in this country for about 15 years. Its production was one of the earliest attempts of the Federal Government to find an industrial outlet for farm products. Furfural may be made from leaves, bark, corn stalks and cobs, bagasse, kapok, sunflower seeds, tan bark and many other products but it is made from oat hulls for two reasons; first oat hulls give a higher yield of furfural than most other products and second, these hulls are already available in one place in large quantities. The first commercial manufacture of furfural was accomplished at the Cedar Rapids, Iowa plant of The Quaker Oats Company and was developed under the direction of The Miner Laboratories.

Three Large Outlets

There are three large uses for furfural: purification of wood rosin, refining of lubricating oils and plastics. Wood rosin as obtained from the pine stumps of the South is a dark colored product, unsuitable for paper sizing, soaps and many other uses. The Hercules Powder Company developed a very ingenious process for making light colored rosins out of this dark product. The crude material, known as FF rosin is dissolved in gasoline, furfural is added to the mixture and thoroughly agitated. The furfural extracts from the gasoline solution a substantial portion of the coloring matter associated with the rosin. Therefore, when the gasoline layer is removed and distilled from the rosin, the product is much lighter in color. Millions and millions of pounds of these so-called pale rosins have been produced by this process at Brunswick, Georgia and Hattiesburg, Mississippi.

This action of furfural is designated by the chemist as selective solvent refining. The same principle is utilized in treating lubricating oils. A few words re-

[1] Part of a paper presented before the sectional meeting on Plastics at the Second Dearborn Conference of the Farm Chemurgic Council, May 12-14, 1936.

garding this use will be of interest here, since any expansion of markets for furfural should inevitably result in lowering the cost of this raw material for resin manufacture.

Most motor oils after hard usage oxidize and form a sludge which collects in the crank case. By treating the oil with furfural that portion of the oil which tends to form a sludge is dissolved and removed by the furfural. Very roughly this may be compared to the separation of a mixture of chalk and sugar. By treating such a mixture with a selective solvent like water, the sugar is washed away leaving pure chalk. Even more annoying to the average motorist than sludge formation is a sluggish motor on a bitter cold morning. Sometimes the oil in the crank case becomes so thick the motor cannot be started in the ordinary manner. To overcome this, lighter oils are used, but an ordinary oil which is very fluid at zero degrees Fahrenheit may be so thin when the motor is hot that it becomes an inefficient lubricant. Furfural refined oils do not exhibit this difficulty, or at least they exhibit it to a lesser degree. Thus with a furfural-refined oil, the average motorist will have less sludge in his crank case in the summer and an easier starting motor in the winter. Another way of indicating the value of furfural-solvent refining is to say that it makes a high quality Pennsylvania oil out of a Mid-continent or Gulf Coastal crude.

It may be interesting to know that all Havoline oil is now furfural refined; that the Gulf Oil Corporation is operating a 5000 barrel per day plant at Port Arthur, Texas; The Texas Company has a 4500 barrel furfural plant at the same location and the Shell interests are operating a (*Continued on page 56*)

Larger objects of unlimited form are equally suitable for molding with furfural

DURITE

NEW IDEAS

● Tiles of paving blocks made of asphalt compositions need not be restricted to black for color effects; according to a new French invention, light and bright color effects can be had in such objects by replacing part or all of the asphalt with a natural or synthetic resin. The mineral aggregate is the main component of such tiles or blocks; the asphalt or resin binder is in general less than 10% of the whole composition. When rosin, copal or dammar or a synthetic resin such as a coumarone or glyptal or phenolic resin is used excellent color effects can be obtained with only moderate pigmentation, and in general it is not necessary to replace all the asphalt with the resin. A typical composition is: resin 7.5, calcareous filler 30, white sand 60, red ocher 2.5%. (Emile J. Claret, French Patent 769,251.)

● In relief printing with gelatin plates there has been much difficulty in preparing thermoplastic forms for shaping the gelatin plates. Much of the trouble arose from the necessity of using a solvent in the thermoplastic form. Finding no success in changing the nature of the solvent, a German inventor has resorted to the bold expedient of making the forms without using any solvent at all. This was accomplished by making the thermoplastic composition of two different ingredients, one with high viscosity and one with low viscosity. The latter, serving as a flux for the entire composition, imparts the necessary flowing properties at the plate forming temperature and so no solvent is required. Lettering and designs are accurately shaped so that the printing plate gives clear, sharp impressions. The thermoplastic may be made, for example, of two polyvinyl chloride or polystyrene fractions of different viscosities; or the high viscosity component may be cellulose acetate or other cellulose ester, with a polyvinyl acetate as the low viscosity component. (I. G. Farbenindustrie A.-G., Frankfort, Germany, German Patent 614,358.)

● The increasing use of plastic products in the construction industry, and the occurrence of fires at sea which have brought to public attention the hazards of wood in ship construction, have sharpened the need and the demand for fireproof plastic materials. To meet this demand the well-known fire-resisting qualities of organic chlorides and fluorides are utilized in a new composition which has the essential nature of a vinyl resin but differs from ordinary vinyl chloride in that at least 2 (sometimes all 3) of the available hydrogen atoms of vinyl chloride have been replaced by fluorine. These fluorinated vinyl chlorides can be polymerized to a perfectly clear, transparent resin which can be sheeted like glass, or they may be used in molding compositions or in opaque (pigmented) sheets. There are many uses for the product where nonflammability and incombustibility are important. (I. G. Farbenindustrie A.-G., Frankfort, Germany, French Patent 796,026.)

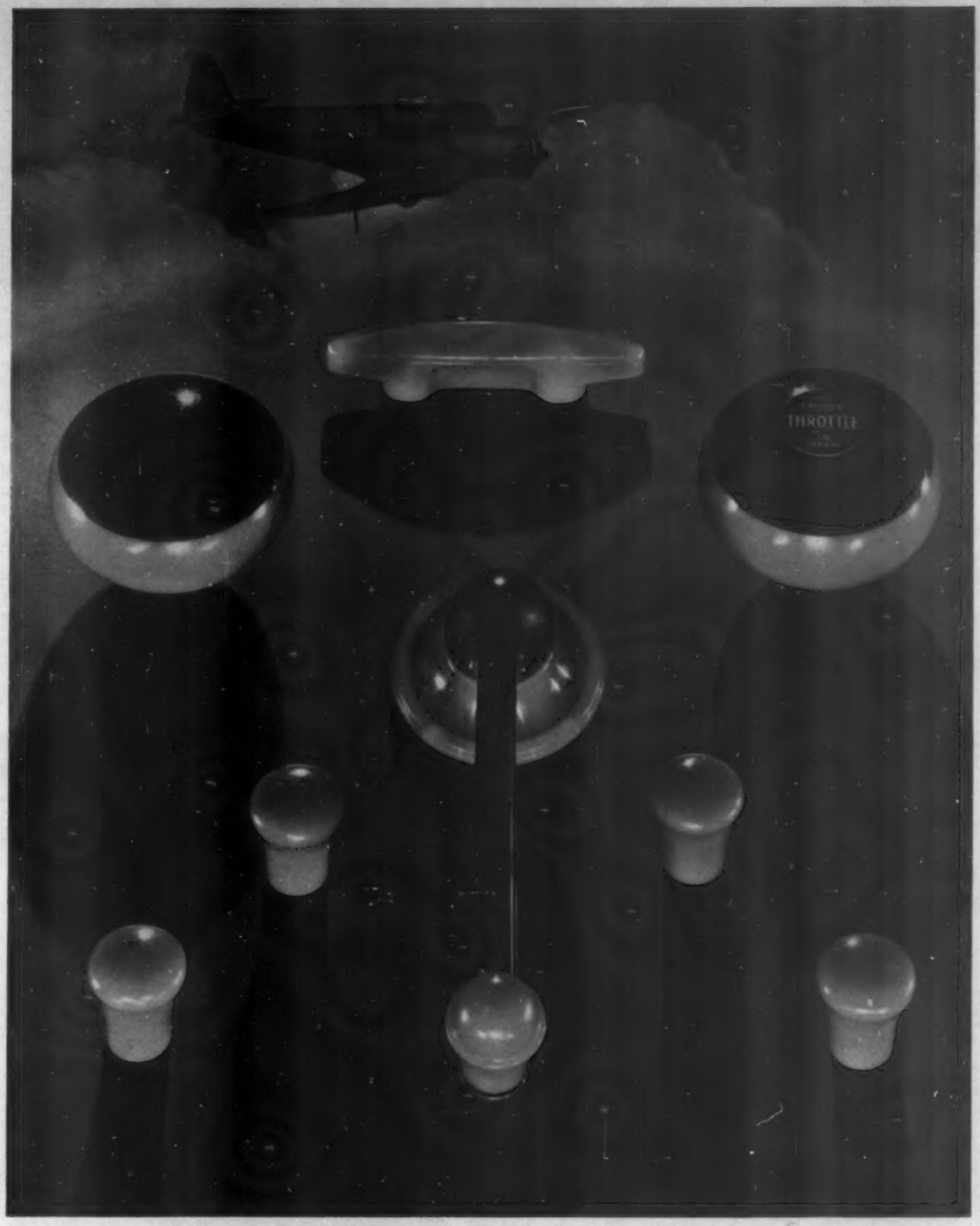
● Cheap molding compositions from which extremely complicated shapes can be easily fabricated are made by condensing phenols, not with aldehydes, but with lignin, peat or lignite. By introducing a small proportion of rubber latex (3-5% of rubber) into the resulting materials the expansion in the molds is such that the molded article conforms exactly to the shape of the mold, no matter how complicated the shape of the article. Metal inserts are also easy to include in the molded shapes. Handles, switch parts and molded insulation are some of the principal forms in which the material may be used. (Studien- und Verwertungs-G. m. b. H., Mülheim, Germany, German Patent 618,182.)

● Lead-jacketed cables are excessively heavy, and the lead sheath is subject to attack by insects and marine borers; but it is not easy to find a substitute for lead because the sheath must resist corrosion, even in sea water, and must resist hot insulating oils. It must also be flexible, with high mechanical strength, and thermoplastic to the extent that it can be applied to cables in a continuous sheathing machine at temperatures which may reach 150° C. (about 300° F.). A light, strong material which meets all these requirements has now been found in plastics of the vinyl resin type, for example polyacrylate esters, polyvinyl acetate, polystyrene, polyvinyl chloride, or interpolymerized mixtures of two or more of these vinyl compounds. Cables can be jacketed with these plastics either by a spray method or in the usual sheathing machines used by cable manufacturers. In addition to a great saving in weight, the plastic cable sheath is less expensive than lead sheathing. (Fritz Schmidt, French Patent 780,470.)

● A new thermoplastic substitute for celluloid is made by copolymerization of vinyl chloride and acrylic acid. The properties of the new material are not what would be expected of a mere mixture of the two components, but those of an entirely different substance having its own characteristics. While the new thermoplastic is quite compatible with other resins and also with cellulose esters or ethers, so that a wide range of plastic compositions can be made from it, the product is excellent for molding compositions in itself and can be worked with the usual tools. Molded articles made therewith are fast to light, moisture and acids. (A. Voss and E. Dickhäuser, I. G. Farbenindustrie A.-G., Frankfort, Germany, U. S. Patent 2,041,502.)

● Luminosity in plastic compositions is a property which opens up a wide range of possibilities in decorative and advertising art. But it is not an easy matter to impart lasting luminosity to a plastic material, and mere painting with luminous paint is not a sufficient answer to the problem. The luminescent substance (usually zinc sulfide compounded with other substances, or strontium sulfide with bismuth and rubidium) requires an embedding agent which will be weatherproof; it must also be durable in other respects, and have high refractive power. The search for such an embedding agent for use in luminous paints led to the use of polystyrene resins in the paint vehicle, and incidentally led also to similar use of the polystyrene resin in thermoplastics, compounded with the luminescent pigment and made up into molded shapes of all kinds. (G. Meder and K. Schad, I. G. Farbenindustrie A.-G., Frankfort, Germany, U. S. Patent 2,039,734.)

● Coagulated viscose (regenerated cellulose) is much superior to the cellulosic pulp (usually paper pulp) which has been used hitherto for insulating electric wire or cable. The viscose insulation can be applied in any desired thickness and can be rendered porous. Premature coagulation of the viscose solution as it is being applied to the wire is avoided by adding a little rubber latex, tannin or other reagent which retards coagulation mildly, not too long but enough for the purpose. The wire may be insulated by applying the viscose in the usual machines for covering wire with insulation. (Allgemeine Elektrizitäts-Gesellschaft, Berlin, German Patent 629,278.)



FAIRCHILD AIRPLANES USE TENITE... for seventeen different appointments, including throttle knobs, dash controls, escutcheons, window-regulator handles, and control stick and flap control column grips. The lustrous smoothness, beautiful coloring, and exceptionally high strength of Tenite which adapt it for this use also make it the ideal plastic for many other industrial and decorative purposes. Write today for a new 52-page illustrated booklet and samples of Tenite.

TENNESSEE EASTMAN CORPORATION *(Subsidiary of Eastman Kodak Co.),* **KINGSPORT, TENN.**

Slicing machine cuts without waste

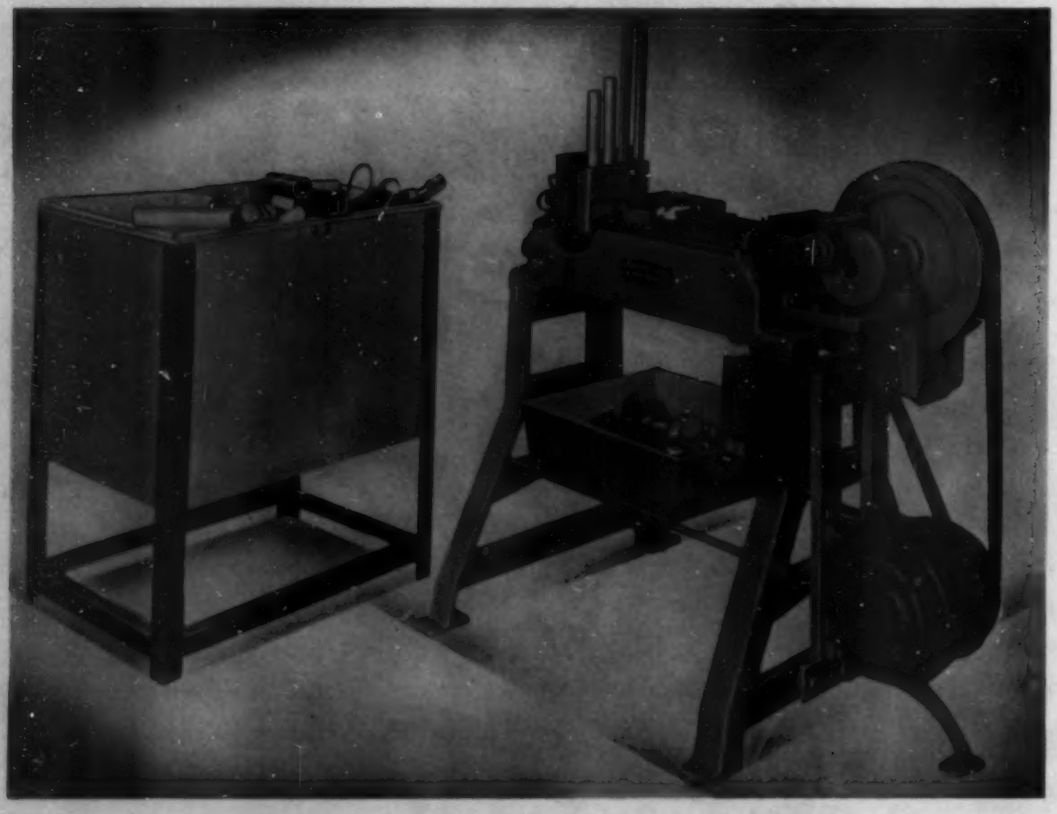
This slicing machine for cast plastics is reported capable of cutting upwards of forty thousand blanks an hour without waste of material

PLASTICS which come in rods, tubes and other forms for conversion into blanks for buttons, buckles, slides, various items of costume jewelry and the like, have heretofore been converted by a cutting process which often involves wasting as much material at each cut as is represented by the thickness of the abrasive wheel or other cutter employed. This waste often reaches 25 per cent. or more of the total material purchased and adds correspondingly to the cost of the finished product. Some efforts have been made to avoid this waste by a slicing or cleaving process, but until recently no machine had been developed which would perform this operation successfully on cast plastics. The Lupomatic Tumbling Machine Co., however, has recently introduced the slicing machine illustrated, which is reported to be in successful use by a number of fabricators. It performs well on any plastic material which can be softened by heating.

The essential elements of the machine are a base with ways for a horizontally reciprocating knife which does the slicing, a connecting rod and crank for moving the knife and holder, a slide to which the holder is attached, a head for holding and feeding the work, and a flywheel with driving means for actuating the machine. Supplementary to the machine is a gas-fired tank for heating the shapes to be sliced and the head of the machine has an electric heating element which keeps the work warm while being fed through the machine.

The machine operates much like a machine for slicing bread except that instead of reciprocating the material to be cut, thus bringing it into contact with rotating knife, the work is held stationary and the knife, which does not rotate, is forced through the material as it is carried forward on the reciprocating slide. The knife is flat on its upper surface and is ground to a sharp edge which is honed. It cuts without waste and, if the material is properly softened by heating, without chipping the blanks being cut. Blanks fall into a basket submerged in water in a shallow tank below the knife and are said to remain substantially flat unless allowed to accumulate in an irregular pile, in which case some slight warpage may occur, although no precautions to prevent warpage are ordinarily taken because it is too small to be of significance.

As will be seen from the *(Continued on page 55)*



CATALIN *fabricators*

CATALIN can be cut as readily as brass or wood

CATALIN for parts of irregular contour are shaped on a standard turning lathe

IVORYCRAFT COMPANY
40-17 22nd Street, L. I. City, N. Y.

Fabricators to the trade of all type handles, cutlery and utensil handles, also knobs and turning jobs featuring large quantity production. Specializing in CATALIN dice and game accessories.

•

PLASTIC TURNING COMPANY
46 Colburn St., Leominster, Mass.

Quality CATALIN products. Featuring items such as jewelry, novelties, cigarette cases, clock housings, toilet articles, handles of various description, silverware and similar items. Modern plant and equipment enable us to turn out the very finest workmanship.

•

KREST MANUFACTURING CO.
329 East 29th St., New York, N. Y.

Specialists in beer and soda fountain dispenser balls and fittings, also gear shift knobs, hardware items, razor handles, radio parts and similar products in large quantities.

•

INDUSTRIAL PLASTICS CO.
643 W. 43rd St., New York, N. Y.

We make a specialty of packaging items for cosmetic products such as powder and rouge boxes, compacts, decorative bottle tops as well as containers suitable for displaying such products as jewelry, hosiery, stationery and similar items.

Industrial applications where accurate dimensions and close supervision are important receive our careful attention.

CATALIN is furnished by us only as raw material in the form of rods, sheets, tubes and special castings. We do not manufacture finished products and for your convenience, offer herewith a partial list of authorized CATALIN fabricators.

Should you desire any special information on manufacturing problems, our Engineering Department will be glad to cooperate with you and, if required, recommend fabricators in your locality who are suitably equipped to do your work.

For your convenience, we maintain at our New York office, a stock room and fully equipped sample department.

HURST, INC.
791 Tremont Street, Boston, Mass.

Your requirements for commercially accurate CATALIN products or parts can successfully be entrusted to us.

New and modern equipment enables us to supply fabricated pieces to exacting specifications. We manufacture for such firms as International Silver Company, Scovill Manufacturing Company, Continental Silver Company and many others.

CATALIN knobs, balls or other ornamental trimmings in beautiful colors will improve your products and build up additional consumer appeal.

Our industrial designers and our modern facilities are at your disposal.

May we serve you?

•

H. KREUL COMPANY
5222 Crane Avenue, Detroit, Mich.

Specialists in fabricated CATALIN products for the automobile trade, radiator ornaments, knobs, handles, fittings of all types. Equipped to do quality and quantity production work.

•

SHOREHAM MFG. CO.
48-17 69th St., Winfield, L. I., N. Y.

Fabricators of millinery, dress and shoe ornaments, display fixtures of various types, also desk sets. We specialize in the carving of CATALIN and the fabrication of sheet material.

•

DOUGLAS TURNER
3025 Watson Blvd., St. Louis, Mo.

For fabricated parts of CATALIN of all types and description, come to "Turner." Our equipment is of such diversified nature as to enable us to take prompt care of your inquiries.

Your inquiries are solicited.

AMERICAN CATALIN CORPORATION

ONE PARK AVENUE, NEW YORK

Utility in display

ONE of the first things to catch the eye upon stepping into almost any drug store at the present time is a large "Air-Spinning" replica of the well-known Coty powder box in the center of the cosmetic counter. Its base is a light-weight molded phenolic in a specially created maroon Resinox which will harmonize with the fixtures in practically every store. Although the top gives the visual impression of movement, it is really an optical illusion effected by the simple trick of balancing a thin fan blade on a needle-like attachment on the bulb inside the box. The blade whirls more than forty revolutions a minute motivated entirely by the heat waves from the bulb.

The molded base is planned to be equally effective on both transparent and opaque surfaces. The bottom has been purposely left hollow so that it may be placed on a glass counter over the full line of Coty cosmetics and illuminate all of the merchandise—as well as make the buyer aware, through the decalcomania lettering on the base, that a new product is being featured in the familiar Coty package. When the display is on an opaque surface, the light is permitted to shine out between the base and the counter to form a lower ring of illumination to attract attention. This is accomplished by means of three small, integrally molded feet which raise the box about three-eighths of an inch from the surface on which it stands. A socketholder extends from within the base and usually carries a 50-watt bulb.

Above, the Coty display unit showing the interior of its molded base and the pin-wheel fan blade which creates the appearance of motion. On the left, the unit as it appears when assembled for counter and window display

The opalescent glass top was specially designed as an enlarged duplicate of the standard Coty orange, black and white package, with the decorations baked on to insure permanence of finish. For window displays, this unit forms the central feature in conjunction with elaborate cardboard displays telling about the new Coty "Air-Spun" face powder.

It is quite fitting that plastics should be selected as ideal in the search for a material suitable to withstand the long wear and hard usage to which store displays are subjected. Not only is it possible to choose a harmonizing permanent-finish color, but the light weight of the material makes it feasible for shipping to all parts of the country at a minimum of expense and the assurance that it will not arrive chipped or dented from careless handling. Because plastics are self-insulating, the box conforms with fire regulations and eliminates the controversy which frequently arises over electrically lighted metal or wooden displays. It provides a unit easy to clean and assemble, tastefully conservative for long-time appeal, and constantly attractive because of its illumination and motion.

Backstage

Co-ordination of plastics activities

Co-ordination of the activities of the G-E Plastics Department under the direction of Vice President C. E. Wilson has been announced by the General Electric Company.

C. K. Mead has been placed in charge of a newly formed Insulation, Glyptal, and Plastics sales section of the Appliance and Merchandise Department, with headquarters at Bridgeport, Connecticut. The newly formed section, besides assuming responsibility for plastics sales, will carry on the activities of the former miscellaneous sales section which was supervised by Mr. Mead and was concerned with the sale of insulation and Glyptal. The new section will be under the general direction, as was the former miscellaneous sales section, of J. H. Crawford, manager of Construction Materials sales.

R. E. Coleman, manager of the Plastics Department, has been transferred to the Appliance and Merchandise Department and will report directly to Vice President Wilson, as will G. H. Shill who has been placed in charge of the manufacturing and engineering activities of the Plastics Department. Nat Stoddard, formerly at Pittsfield, is now at Bridgeport.

Premium exposition

The 2nd Annual Atlantic Coast Premium Exposition will be held at the Hotel Astor, Times Square, New York City, from September 28 to October 2. A number of Round Table conferences of interest to sales and advertising executives and premium sellers are planned as well as addresses and discussions by specialists in their individual fields.

Apropos of this important show, we are planning to run a comprehensive story of plastic premiums in the September issue of MODERN PLASTICS telling of the many types of premiums available in price ranges from one cent to five dollars and up.

Preference in color

Out of every 100 buttons made today for women's dresses, 50 are white, 25 are red, 5 are pink, 5 are yellow, 5 are blue, 4 are green, 1 is orange, and 5 are scattered through the several thousand other colors available. The figures are taken from the manufacture of Plaskon, a material widely used for colored buttons, and are released by the Plaskon Company, Inc. for the guidance of the trade.

Popularity of colors differs in other fields. In cosmetic packaging, for example, red is the favorite color, blues of all kinds run second, and ivory is third. In still another field, that of electrical manufacture, ivory represents 95 per cent. of the total production. Although the Plaskon Co. keeps over 7,000 different color shades in its record files, almost the entire production is in 21 hues.

Backstage

New plant completed

Construction work on a new addition to Bakelite Corporation's 125-acre plant at Bound Brook, N. J., has just been completed. This building, containing 12,000 square feet of floor space, will be devoted entirely to the volume production of Bakelite Resibond, the new phenolic plywood and veneer adhesive film. The company reports that the newest coating equipment for the production of extra large sheets of Bakelite Resibond is being installed and is expected to be put into operation about September first.

Armature Impregnating Resins

For the impregnation and coating of motor and generator armatures, General Plastics Inc. has developed several improved thermosetting resin solutions. Instead of being dependent upon mere oxidation as is the case in oil varnishes, these resins set up to a permanent and infusible film by chemical reaction. Other values claimed for the resins are higher insulation and greater resistance to water, oils and chemicals, plus a stronger mechanical bond between wires and armature frames, which prevents the wires from throwing out at high speed. Metal castings are also impregnated with these resins to reduce porosity, subsequent baking hardening the resin infusibly.

Facilities expanded

Reception of their new product, ethyl cellulose, has been so satisfactory that the Hercules Powder Co., Inc., have enlarged their plant and are now in a position to supply increased quantities of this material and to take care of its expanding markets.

The unusual properties of ethyl cellulose which point to its use in varnishes, lacquers, adhesives, plastics and other compounds, are described in a booklet published by Hercules Powder Co., which is available to our readers by writing to the Books of the Month editor. Also included in the booklet are tables showing the solvents, plasticizers and resins best adapted for use with ethyl cellulose.

Designer moves

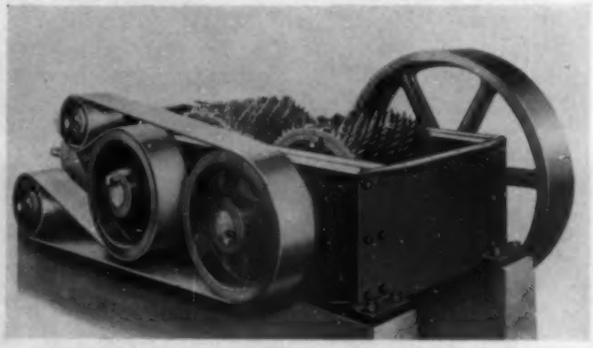
William J. O'Neil, industrial designer, has removed his studios from 155 East 34th Street, to 299 Madison Avenue, New York, where he will continue to serve manufacturers in the design of their packages and products. Mr. O'Neil, a former advertising agency art director for McCann-Erickson, Cleveland, and Young & Rubicam, New York, has been operating as free lance industrial designer for the past five years.

McElhone to New Post

H. C. McElhone, who has served in various capacities in the works, headquarters sales, stock control and executive departments, has been appointed assistant to vice president of the Westinghouse Electric and Manufacturing Company. Associated with Westinghouse since 1919, Mr. McElhone for the past five years has been attached to the president's office.

Double roll crusher

The Jeffrey Manufacturing Co. has developed a new design of double roll crusher. The chief feature of this machine is a self-contained endless belt drive between the rolls which allows quick adjustment of the rolls within the limits of the sizing range while the machine is running. The crusher is also provided with an all steel frame having heavy steel cross-ties.



New resins for cellulose ester lacquers

Bakelite Corporation has recently announced a new type of Bakelite resin which has been developed especially for use in cellulose ester lacquers of the modern high gloss, high solid content type. At present two modifications are available, XR-3180 and XR-4357. These new resins are the result of systematic research, extending over several years, in which the primary object has been to overcome to the greatest practical degree the recognized defects of lacquers previously available for certain exacting requirements. Chief among these has been the difficulty of obtaining a smooth, high gloss surface without the necessity of incurring additional expense for rubbing and polishing operations.

XR-3180 and XR-4357, in combination with nitrocellulose, yield lacquers of exceptional flow and gloss. Their high refractive index and excellent pigment wetting produce a most attractive depth and lustre. The initial high gloss is retained remarkably well on exposure to weather and even after long service these finishes may be cleaned and repolished with little effort. In addition to this important property, these resins are also outstanding in their resistance to mois-

Backstage

ture, oxidation, strong soaps, acids, oils and greases, and have an excellent degree of color stability. Their solutions in common lacquer solvents are very low in viscosity, permitting the formulation of high solid content lacquers having excellent film building properties. Because of the combination of desired characteristics, lacquers based on these resins have particular value for the following applications: automobile finishing and refinishing, refrigerators, kitchen furniture, cabinets, bathroom fixtures and imitation tile, hospital furniture, textile and paper coatings, metal lacquers for hardware and instruments.

Office in Ecuador

Hipolito Espinosa M., representative of foreign manufacturers and exporters, whose headquarters are located in Guayaquil, Ecuador, South America, announces that he has facilities for sales promotion of almost any type of product in that country.

Now in public relations

Miss Harriet B. Meyer, who recently directed the 1936 Exhibition of the American Glass Industries, and has been in charge of the Industrial Art Department of the Brooklyn Museum, is now associated with the firm of Leon V. Quigley, public relations counsel, 730 Fifth Avenue, New York.

Molders at Wawasee

Western molders met for a day of golf, tennis, fishing and all kinds of outdoor—and indoor—sports, and general good-fellowship at Lake Wawasee, Indiana, on June 30. Unfortunately, MODERN PLASTICS went to press before the bad news of the golf tournament was available. W. L. Kelley of Chicago Molded Products was chairman of the committee in charge of arrangements, which is sufficient to insure their success.

Books of the month

Organic Plastics

By Gordon M. Kline

Circular C411 of the National Bureau of Standards

The modern plastics industry deals chiefly with moldable materials manufactured from organic compounds. Synthetic resins, natural resins, cellulose derivatives and protein substances are the four principal types of these organic plastics. The inorganic molding materials, such as concretes, cements, and ceramics, and also rubber, an organic substance, are not generally included within the scope of the plastic trade as it is known today, inasmuch as the industries utilizing these materials are considerably older and were already individually organized and developed prior to the advent of the newer plastics.

Books of the month

In order to meet a growing demand for information regarding the organic plastics, this circular has been prepared. The various organic plastics are discussed from the standpoint of raw materials required, chemical reactions involved, various methods of processing, and the more important applications.

The synthetic resins are subdivided into several chemical types as follows: phenolic-aldehydic, amino-aldehydic, vinyl, hydroxy-carboxylic, indene, organic-polysulphides, and miscellaneous. Some of the more familiar industrial products which are discussed in this section of the circular are Bakelite, Catalin, Beetleware, Vinylite, Glyptal, Thiokol and Duprene. Natural resins of animal, vegetable and mineral sources are described. Typical examples of the natural resins from these three sources include shellac, rosin, and asphalt, respectively. The chemistry of the cellulose esters and ethers and cellulose xanthate is outlined. Celluloid, Fiberloid, Plastacele, Tenite, and Cellophane are among the well known cellulose plastics discussed. The protein plastics considered include those prepared from casein (milk), blood albumin, and soy beans. Selected references are listed at the conclusion of the circular for the convenience of the reader who may be interested in further details regarding the manufacture, properties, and uses of organic plastics.

Copies of this circular may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., at five cents each.

One Thing Leads to Another

By Fred C. Kelly

Houghton Mifflin Company
$1.75, 105 pages

This is a biography of a business which is also an interesting tale of adventure—pioneering in new fields of science. It tells of the romance of an industry that has developed since the World War on a scale no one could have foreseen. The reader, in following the story of one business corporation, catches a glimpse of the manner in which any successful business starts and goes through stages of growth. Products of prime importance today become secondary tomorrow, as new ideas, new processes, and new demands bring constant changes.

Scores of articles that now add to the comfort and well-being of millions would not have been possible except for the industrial developments that started in a laboratory. Yet the processes originally used give way, to be superseded by other marvels of discovery and application. Each manufacturing step has suggested something else. One Thing Leads to Another.

Though barely sixteen years old, the business described (Commercial Solvents Corporation) has already gone through astonishingly evolutionary stages. It is a unique business. No other quite like it exists anywhere in the world.

Fred C. Kelly, the author, has long been a magazine writer, journalist, and world-traveler. He began

Books of the month

newspaper work at the age of fourteen. Years ago, he wrote the first daily syndicated column from Washington. His books include several on finance and economics, and this is his second dealing with the history of a business corporation. The book is dramatically illustrated with photographs by Margaret Bourke-White which make it impressionable as well as entertaining and instructive reading.

New British quarterly

Trend In Design, official quarterly of the Design and Industries Association, London, made its initial appearance recently. Obviously ambitious, delightfully frank, the paper sets out to record the movement for better design in everyday things, to point out opportunities, welcome achievements, create a clearing house of those facts and ideas which designers, makers, sellers and users equally and urgently need.

It is favored in editorial content with outspoken expressions for and against current design by those in industry and trade well qualified by experience to understand its values and limitations. The publication recognizes the stultification this machine age has brought to so many of the everyday things we buy and use and proposes to point out ways and means for the designer, manufacturer, distributor and buyer to control machine production through definite improvement in appearance and utility of things produced.

Unlimited in its range of subjects, *Trend In Design* steps courageously into a field as difficult as it is important. It deserves the hearty support of all industry which is destined to benefit by the regeneration to which industrial design has demonstrated it can contribute, even in trying times.

Products list

General Plastics, Inc., announce a new book just off the press, which gives physical property data on all of the standard Durez phenolic molding materials, including blacks and colors. Designed for molders, manufacturers having molding equipment and those buying molded parts, the book also includes data on molding technique, and part design. Sent upon request to manufacturers in the above categories.

Silent partner of broadcasting

(*Continued from page 15*) likely to wrap under use. Vinylite records allow much finer and closer sound tracks and give more faithful reproduction of sound. Vinylite wears longer than cellulose acetate but being more brittle will not flex to such an extent as cellulose acetate without breaking.

Again referring to phenolics, both the loss resistance and heat resistance of this type of plastics is improved when mica or other mineral filler is combined in molding. Power factors as low as 0.6 per cent. are obtained by this means whereas wood-filled types may show losses as high as 3 to 12 per cent. or more. Fab-

ric-filled or laminated moldings are often employed in parts that will be exposed to shock stresses. Their resistance to shock is sometimes 20 or more times as great as that of wood-filled moldings.

In broadcasting equipment plastics are used rather more extensively than diversely. The volume and number of applications is large, but the variety is fairly small. Most of the work in broadcasting plants is ordinary light circuits, battery systems, enunciators, phone lines, low voltage motor and generator circuits and all the switches, panels, jacks, patchcords, and other accessories that go with them. Thus the volume applications are phenolics engineered for the various fairly routine requirements.

High frequency circuits that require the dielectric strength of styrol types of plastic are relatively few. The new micro-wave transmitter, developed by N.B.C. and associates, is a striking example. No bigger than an ordinary microphone, with the only attachment a light, yard-long antenna, it has a range of three or four miles, operating on power from batteries enclosed in the set. Speakers carry it around, talk, and are picked up by the "mother" station, blocks away, and relayed to the air again. Antenna bushing, tube socket support, and other insulating members are made of styrol. Likewise, high-frequency transmitters, used in the broadcasting plant or in experimental work, resort to this or a similar plastic material.

Permanent exhibit

(*Continued from page 21*) attempted, hospital lamp shades, a number of articles molded by the injection process, fishing reels, dentures, and examples of the new transparent resins so popular in aircraft, give concrete evidence of the remarkable progress made with plastics in the past few years.

This exhibit, conveniently arranged to make it easy for those interested to get the most benefit from their visit in the shortest time, provides an opportunity to see just what has been accomplished with plastics in the past year and to indicate the unlimited possibilities for their future development.

Among the exhibitors are: American Catalin Co., American Cyanamid Co., American Insulator Co., Auburn Button Works Inc., Bakelite Corp., Becker Moore & Co. Inc., Boonton Molding Co., Chicago Molded Products Corp., Colt's Patent Firearms Co., Commercial Solvents Corp., Consolidated Molded Products Corp., Diemolding Corp., E. I. du Pont de Nemours & Co., Economy Fuse and Mfg. Co., Emeloid Co., Fee and Stemwedel Inc., Fiberloid Co., Flexo Supply Co., General Electric Co., General Laminated Supply Co., General Railway Signal Co., Gorham Co., Heveatex Corp., Hygienic Tube & Container Co., Imperial Molded Products Co., Index Machinery Corp., Indicater Corp., Johns-Manville Co., Kellogg Switchboard & Supply Co., Kurz-Kasch Co., Lusteroid Container Co., Luzerne Rubber Co., Mack Molding Co., Makalot Corp., Marblette Corp., Mica Insulator Co., Mundet Cork Co., Northern Industrial Chemical Co., Packless Metal Products Corp., Plaskon Co. Inc., Quality Turning Co., Recto Molded Products Co., Resinox Corp., Richardson Co., Rohm

& Haas Co., Safety Grinding Wheel & Machine Co., Shakespeare Co., Sillcocks Miller Co., Synthane Corp., Synthetic Molded Products Co., Tennessee Eastman Corp., Terkelsen Machine Co., Universal Molding Co., Unyte Corp., Victor Metal Products Corp., Waterbury Button Co., Watertown Mfg. Co., Wheeling & Stamping Co. and Ziwel Products Company.

Okays plastic radios

(*Continued from page 32*) illustration shows how well they have handled the physical appearance. You will find its tone and power are also surprisingly good. Design credit for this new Silvertone Compact goes to John Morgan, Sears Roebuck designer, and it embodies some unusual construction features, too.

As far as we know, the Silvertone is the first Compact radio to be molded with the bottom end open instead of the back. This is an obvious improvement since it looks equally well from front or back, and probably many other designers saw the logic of this construction but could not do it without side hole bars which slow up the molding operation. Mr. Morgan accomplished it by using straight-drawing vertical columns for the grille. Light colored grille cloth is cemented over the entire grille front and back from the inside. This permits assembling the entire chassis and speaker as a unit, which can even be tested with the case off. The case drops down, fastens with a couple of screws in the bottom, the dials snap on, and the radio is complete.

Although the cases are molded of black and brown Durez, the large domed dial is made of light colored urea for contrast. On the brown set, an ivory dial with brown numerals makes a rich and pleasing combination. The biggest feature of the set—the one that surprises everyone who sees and hears it—is its price."

Plus or minus zero

(*Continued from page 16*) when the tube is "in." This means a perfect timing of threaded plugs and threaded rings in all cavities of the tube and case. It may seem simple, that by merely twisting the case plug or tube ring this could be accomplished. Not so, because the threads in the plugs and rings must all start in exactly the same position. It should also be noted that the force of the case telescopes the threaded plugs.

Inasmuch as all three parts have to be interchangeable, the various cavities were made to exceptionally close tolerances. While this interchangeability is more or less controlled by the accuracy of the mold, it was necessary to maintain a careful control over warpage and shrinkage, due to the variations in wall thicknesses of the case and back. This led to the development of a new method of determining the correct cooling cycle for the molded pieces. Hitherto it has been common practice for molders to set an arbitrary cooling time for precision work. In the molding of the Bullet camera, however, such close tolerances had to be maintained that this method immediately proved impracticable. Variations in finished molded pieces were too

great. To overcome this condition the molding press was equipped with recording thermometers on both the top and bottom platens. It was soon discovered that the time required to cool the pieces to a specified temperature, by running water into the mold, changed with each heat. In some instances it took as much as three minutes and in others two minutes or less. Further testing revealed that the cooling temperature which achieved the highest degree of accuracy in tolerances was 270° F. By carefully watching the thermometers, it is now possible to know immediately when the pieces have cooled to the proper temperature to be removed from the molding press.

At the present time there are eight case plugs and eight tube rings operating, and the parts produced from them are all interchangeable—absolutely no fitting being necessary. Still another feature in the production of the Eastman Kodak Bullet Camera is the special treatment given to the mold surface for the inside of the case as well as the inside of the tube. This is necessary to prevent reflection of light on the film when the shutter of the camera is opened.

The Bullet camera can safely be considered the last word in precision molding. It serves as an example of what may be expected of molded plastics in the future, for precision instruments dependent upon accuracy and very close tolerances for their successful efficient operation. Credit: To Auburn Button Works, Inc., for the dies and molding. To Bakelite Corporation for the special non-fogging molding material.

Cuts without waste

(*Continued from page 42*) accompanying illustration, the work is inserted in a bronze head with cored holes which fit the piece to be sliced but with sufficient clearance to permit it to fall through freely under its own weight. Just before the piece is cut, it rests against a stop which is adjustable so that blanks of any desired thickness between the limits of 0.040 and 1.5 in. can be cut. Three or more pieces of plastic can be cut at each stroke if the holder is provided with this number of openings. An operator usually has as much as he can do to see that three pieces are heated and kept feeding into the machine but as the cutting knife is 8 in. broad, more than three rods or tubes can be fed simultaneously if their total thickness does not exceed the knife's width. Since the knife is commonly reciprocated at a speed to make 180 to 270 cutting strokes a minute, the total number of blanks cut per hour may equal this number of strokes times 60 times the number of rods or tubes being fed, giving a very high rate of production with no loss of material beyond, perhaps, the first and final blank cut from each rod or tube.

In the original machine (illustrated), the work was fed under its own weight but recently an added fixture with weighted rods bearing against the top of the work has made the feed more nearly positive. As the knife cuts through the piece, it finishes its stroke in a piece of (renewable) fibre which supports the work at the level of the knife and prevents it from chipping at the end of the cut. At the same time, the stop is pushed forward against springs which allow blanks to

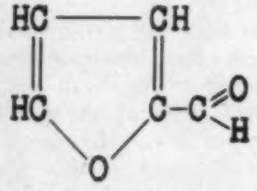
fall into the basket below. On the return stroke, the stop is returned by the springs and, as soon as the knife clears, the rods or tubes being sliced fall against it and are thus positioned for the next cut. The machine is provided with or without a motor. Hard bronze bushings are used in the connecting rod and shaft bearings and the ways have adjustable strips arranged to secure a close fit on the slide which carries the knife and must reciprocate without play.

The machine is used chiefly for slicing cast phenolics which are so cured that they can be softened to the required degree by immersion in hot liquid in warming containers. Rods and tubes being heated are placed in metal baskets which the operator can raise so as to remove them without reaching below the liquid level. It is designed to cut rods or tubes (or slabs) up to 3 in. in diameter or thickness and has been employed extensively for odd shaped sections as well as for circular and other geometric shapes.

Furfural in plastics

(*Continued from page 39*) furfural plant in England. The total daily capacity of the furfural solvent refining plants in the world is not far from 15000 barrels of oil per day. There is little doubt but that other refiners will adopt the same process with similar success within the near future.

The solvent uses for furfural just described account for two of the three large uses of this product and now we come to the use of it and its derivatives



Furfural

in plastics which is the third large use. A study of the structural formula of this compound shows that it should have almost infinite possibilities for the formation of resins. In the first place it is an aldehyde, hence should react to some extent as does formaldehyde. In the second place, it is a heterocyclic compound, and is closely related to thiophene, pyrrol, and coumarone, derivatives of which are noted for their resin forming ability. In the third place the heterocyclic ring possesses conjugated double bonds which condition is favorable to polymerization. Finally the ring may be broken with various reagents to give other products suitable for resin formation. Only one of these latter reactions will be mentioned at this time—namely oxidation, which under suitable conditions converts furfural to maleic acid or anhydride. Indeed the latter bears a very close resemblance to furan.

The only really large use of furfural in plastics has been in the manufacture of phenolic resins. The

largest manufacturer of these resins is Stokes and Smith who have been making furfural resins called Durite for some fifteen years. For various reasons the development of these has remained largely in the hands of one or two manufacturers and the research devoted to improvements in furfural resins has been but a small fraction of that given to formaldehyde products. It is probably safe to predict that improvements in furfural resins and sales of furfural to resin manufacturers during the next ten years will proportionately far surpass improvements in and sales of formaldehyde-phenolic resins. Some of the reasons for this prediction are as follows:

Change of Research

Ten years ago there were factors which encouraged a widespread study of formaldehyde resins and discouraged a similar study of furfural resins. These factors are almost directly reversed at the present time. Furfural-phenol resins,[10] in general have better resistance to moisture and acids; they withstand high temperatures better. There is reason to believe that the old handicaps of slow curing and dark colors may soon be removed or at least be substantially reduced.

From a yield standpoint furfural resins have a definite advantage over their formaldehyde analogs. For example, if it be assumed that in a finished resin, equimolecular quantities of aldehyde and phenol have reacted with the liberation of one molecule of water, it is evident that every time 30 pounds of formaldehyde or 81 pounds of formalin react, 18 pounds of water will be lost. On the other hand 96 pounds of commercial furfural will combine and liberate but 18 pounds of water. On this basis 190 pounds of furfural and phenol will theoretically produce 172 pounds of resins whereas 175 pounds of formalin and phenol will give 106 pounds of resins. Therefore from the standpoint of practical results already obtained and from theoretical considerations the future of furfural in the phenolic resin industry appears bright.

The use of furfural is not limited to phenolic plastics. This aldehyde will react with urea,[8, 9] casein,[4, 14] amines,[1, 7] lignin,[12, 13] ketones[7] and sulfonamides.[3] Although these reactions have not been developed to the point of industrial importance there is every reason to believe that at last some of them will be.

Dreyfuss[2] and Moss and White[7] state that aniline furfural resins which are compatible with cellulose acetate also become lighter in color upon exposure to light. Phenol-formaldehyde resins darken under similar conditions. They claim that a light fast plastic may be made from cellulose acetate, furfural-aniline and formaldehyde-phenol resins. Huxham[5] describes the preparation of cold molded insulators from furfural-aniline and phenol-formaldehyde plastics. Cherry and Kurath[1] have prepared wax substitutes from amines, organic acids and furfural.

Casein plastics[4, 14] as well as gelatin printers' rollers[15] may be hardened and waterproofed with furfural. Black lustrous resins resembling ebonite are formed from furfural and urea by the use of acid catalysts.[6] Novotny and Johnson[9] state that the use

of sodium carbonate rather than hydrochloric acid in this reaction is preferable. These same ingredients are suitable for making varnishes, impregnating agents, etcetera Formaldehyde-p-toluene sulfonamide condensation products have been used in connection with cellulose acetate in preparing safety glass.[8] Furfural may be substituted for the formaldehyde in this reaction.

Modern Furniture

A great deal of thought has been given to the use of synthetic resins for furniture, floors and building materials. A demonstration house has been built in which the floor is of furfural-oxycellulose composition. Furfural-lignon resins[12] have been made and the chances are at least even that furfural and sawdust will eventually furnish the raw material for millions of feet of lumber substitute.[13]

It was mentioned above that maleic anhydride could be made by oxidizing furfural. At a reasonable price maleic anhydride would probably be a serious competitor of phtalic anhydride in the manufacture of alkyd resins, i. e. those resins made from polyhydric alcohols and polybasic acids. A patent[17] has been issued claiming high yields of maleic anhydride from furfural and even admitting that the patent claims are optimistic there may be a great quantity of maleic anhydride made from furfural during the next decade.

Furfural is hydrogenated to tetrahydrofurfuryl alcohol and K. H. Hoover working in the Miner Laboratories produced excellent resins from the tetrahydrofurfuryl ether of glycerol and phthalic anhydride.[3] In connection with alkyd resins H. C. P. Weber[16] claims that furfural-phenol resins combined with alkyd resins give products of excellent characteristics. The product possesses the insulating qualities of alkyd resins and in addition has the superior molding characteristics of furfural-phenolic resins.

Furfural can also be hydrogenated to furfuryl alcohol[11] which resinifies with mineral acids. For years laboratory table tops have been treated with acid followed by an application of furfuryl alcohol, whereby a water-proof, acid-proof black resin is formed in situ. Within the past year one of the large paint manufacturers in Chicago has developed a coating material based on this reaction. There is little doubt but that the possibilities of tetrahydrofurfuryl alcohol and other hydrogenated products of furfural

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are virtually unexplored but in the field of plasticizers coating materials and resins there will undoubtedly be significant advance within the near future.

Unlimited Sources

In summation it may be said that in furfural there is a compound potentially available in practically unlimited amounts; a compound which will probably be made only from farm products, a compound which because of its unique chemical composition has already made a place for itself in a competitive market and a product which of itself and through its oxidation and hydrogenation derivatives holds promise of developing to many times its present importance. A complete properties chart will be sent upon request.

Light-polarizing glass

(*Continued from page 35*) in important advances optical applications such as ophthalmology and television, because of the larger area available as a source of polarized light.

The herapathite crystals are suspended in a cellulose plastic, such as cellulose acetate. Each square inch of the film which is only a few thousandths of an inch thick, contains in the neighborhood of one thousand billion of the small crystals. In order to obtain useful polarized light, the crystals must be made to lie with

Strains set up in transparent material such as clear Bakelite, or Marblette, or glass, can be detected instantly by placing the material between two discs of Polaroid. Illustration shows the strains set up by applying pressure to a Celluloid U

their axes parallel. This orientation is accomplished by stretching the plastic film. In this manner the film becomes optically equivalent to a single large crystal. The film is cemented between glass plates which protect it from surface injury and atmospheric deteriorating influences.

Single sheets of the new light-polarizing glass are clear and colorless. Light that has passed through it appears as ordinary light; the light rays, however, are polarized so that all vibrations of the rays occur in one plane. Two sheets, one over the other, may be transparent or opaque, depending upon how they are turned in relation to one another. The opacity

is produced by "crossing" the respective axes of the crystalline components of the two sheets, so that the polarized light transmitted by one is totally absorbed by the other. In other words the superposed sheets of Polaroid form a simple polariscope, the first plate being the polarizer and the second the analyzer.

In addition to its use in studying stresses in plastic models of buildings, bridges, machines, etc., this material should also be extremely helpful in detecting strains left in transparent products, molded or cast from synthetic resins and cellulose plastics. Its use is also indicated for the examination of test specimens of transparent plastics, in order to establish the absence of any initial stresses which would affect the behavior of the sample during the test.

Photoelastic analysis

(*Continued from page 37*) will have a maximum and Sy a minimum value, while the shear stress t vanishes. For this particular position, the stresses are known as *principal stresses* and the planes to which they act normally are known as *principal planes.* The principal stresses will be designated as S_1 and S_2. The quantity $\frac{(S_1 - S_2)}{2}$ is known as *maximum shearing stress.* This latter stress plays an important part in the ultimate failure of structures made of non-brittle material.

Non-uniform variation of stress across a section is a very common phenomenon in practically all types of machines and structures, no matter what material is used in their construction. If a model of different material is used in the study of stress intensities, the results obtained can be applied to the prototype after proper allowance is made for the differences of the elastic constants of the two materials. The general behaviour of distribution of stress, however, will be the same for two-dimensional stress problems.

Optics of polarized light

The phenomenon of polarized light was first discovered in 1699 by Bartholinus who noticed that when a ray of ordinary light is passed through a crystal of calcite, such as Iceland Spar, it is refracted into two rays, called respectively *ordinary* and *extraordinary* rays. These two rays vibrate in two fixed planes at right angles to each other. The light thus obtained is called *plane polarized light.* Ordinary light such as that from the sun, an electric bulb, mercury lamp, etc., is not polarized and therefore its vibrations are in planes of any possible orientation. Besides calcite and other crystals, polarized light can be easily obtained by reflecting light at the polarizing angle from a glass plate with a black coating at the rear surface. This angle for glass is about 57° with the normal to the plate. Recently specially prepared laminated glass plates known as *Polaroid* are gradually replacing the Iceland Spar polarizers, called Nicol Prisms, because of the greater cost of the latter in the construction of large-size polariscopes.

In 1816 Brewster, a British physicist, found that when a plate of glass initially free from internal strain is examined with polarized light, there is nothing vis-

ible to the eye. But if the glass plate has initial strains due to imperfect annealing, or if it is stressed by applying an external pressure on its edges, then these stresses become visible in polarized light in the form of a beautiful pattern of fringes, called *interference fringes of stress* or simply *isochromatics*. These fringes will be in multicolor, if observation is made with white light, which is known to be a mixture of light of different wave lengths. If the light is made monochromatic (of one wave) by using a light filter, the pattern will

Fig. 6. Direction of principal stresses for a circular disk under concentrated loads

consist of black and white fringes, as in Figure 2.

An optical arrangement for studying doubly-refracting objects in polarized light is called a *polariscope*, of which a simple arrangement is shown in Fig. 4. Light rays from source (1) are collected by the condensing lens (2) and sent in parallel rays through a polarizing glass plate of which the plane of transmission is assumed to be vertical, as shown by a set of imaginary lines. Thus the light after its exit from the polarizer will have its vibrations only in a vertical plane. If in the path of this light another polarizing plate, called the analyzer (5), is set with its plane of transmission horizontal, no light will pass beyond it to the screen. The two polarizing plates are said to be *crossed*.

When in a polariscope of this type, a rectangular plate (4) of a transparent isotropic material, such as glass, Celluloid, Bakelite, Marblette, etc., is introduced between the polarizing plates, the image on the screen will be still dark, provided there is no initial strain in the plate. Now, by applying a gradually increasing load on the plate, the image will gradually brighten to maximum intensity and then back to darkness again with the increase of the load, provided monochromatic light is used.

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This will form the first cycle of stress and the darkness produced after illumination will correspond to the *first order fringe*. By increasing the load to twice the value corresponding to this first order fringe, the cycle of illumination-extinction will be repeated, giving the *second order fringe*, and so on for higher orders. If *white light* is used without a light filter, the fringes instead of being black and white will be in colors. The stress in a one inch thick tension test piece corresponding to one fringe interval is called the

Fig. 7. Stress pattern for a circular disk under concentrated loads

fringe-stress equivalent for the material tested. It will be seen later that this stress-fringe number which is a measure of the *optical sensitivity* of the material, is very important in the selection of a transparent material for photoelastic purposes.

If, instead of the simple-tension test piece, we use a plate as in Fig. 3 in which the stresses can be at any possible orientations in the plane of the plate, a ray of the polarized light will be *doubly-refracted* at the incident surface of the stressed plate and two separate rays will be formed. One of these rays will vibrate parallel to S_1 and the other parallel to S_2, where S_1 and S_2 are the principal stresses acting at the point considered. The velocities of the two rays are found to be proportional to the numerical values of S_1 and S_2, and as these usually are not equal to each other, one ray will pass through the plate faster than the other. Upon exit there will be a *phase difference* between the two rays, proportional to $(S_1 - S_2)$. When the two rays, now vibrating in two mutually perpendicular planes reach the analyzer, only their components parallel to the plane of transmission of this plate will be transmitted. Finally, as the two rays now vibrate in one plane and have a relative phase difference, there will be *interference* between the two rays.

As a result of such phenomena taking place at all points in the stressed model, the image will be covered with a continuous system of fringes, each of which will be a contour of constant stress $(S_1 - S_2)$, proportional in intensity to the order of the fringe. When the value of $(S_1 - S_2)$ is zero at a point, then the fringe through this point will be that of zero order. When $(S_1 - S_2)$ has such a value at another point that it produces a phase difference equal to one wave length of light used, then the fringe through this point will be of first order, and so for the higher orders.

When it is desired to determine the *directions* of the principal stresses S_1 and S_2, the process will be as follows: It is evident that when the stress S_1 at a point is parallel to the direction of vibration of the light from the polarizer, a ray at this point will not have a component parallel to the stress S_2, upon exit from the plate. Since the axis of the analyzer is at right angles with that of the polarizer and also of the stress S_1, the light will be stopped by the analyzer, and there will be extinction of light on the screen for all points having stress S_1 parallel to the axis of the polarizer. As a result there will be in the multicolor stress pattern one or more black bands called *isoclinics*, which represent contours of constant inclination of principal stresses. Fig. 5 is a picture of 0° and 90° isoclinics for a circular disk under axial compression. By keeping the model fixed and rotating the polarizer-analyzer, through constant intervals of 10°, isoclinics of 0°, 10°, 20° . . . 90° are obtained, as shown in the left half of Fig. 6. From these isoclinics the directions of the principal stresses can be traced graphically, as shown by the *stress trajectory curves* in the right half of Fig. 6. Lines drawn at 45° with these stress trajectories will give the directions of the maximum shear lines, similar to the slip lines obtained in the testing of metal specimens.

In a stress pattern, the presence of the isoclinics will destroy the clearness of the stress fringes. To overcome this, a pair of *one-quarter wave retardation plates* are placed between the two polarizing plates, with their axes at 45° to those of the polarizer and analyzer, but at 90° with each other. This arrangement transforms the original plane polarized light into *circularly polarized* light and thus removes the isoclinics from the stress pattern, leaving the fringes intact, as seen in Fig. 7.

Thus far we have the value of the principal stress difference $(S_1 - S_2)$ and the directions of S_1 and S_2. It is necessary to have the actual values of these stresses to make the solution complete. There are many analytical or graphical methods of doing this. The most practical way is to measure the change of thickness of the stressed plate at a point by means of a lateral extensometer, from which the sum of the principal stresses $(S_1 + S_2)$ can be easily evaluated. Then for a given point we shall have the values of $(S_1 - S_2)$ and $(S_1 + S_2)$ stresses, the simultaneous solution of which will give us both S_1 and S_2 in magnitude and sign (tension or compression). With the results thus obtained, the stress distribution for any section at any given orientation can be easily computed and graphically represented for the exact and economical design of machines or structures.

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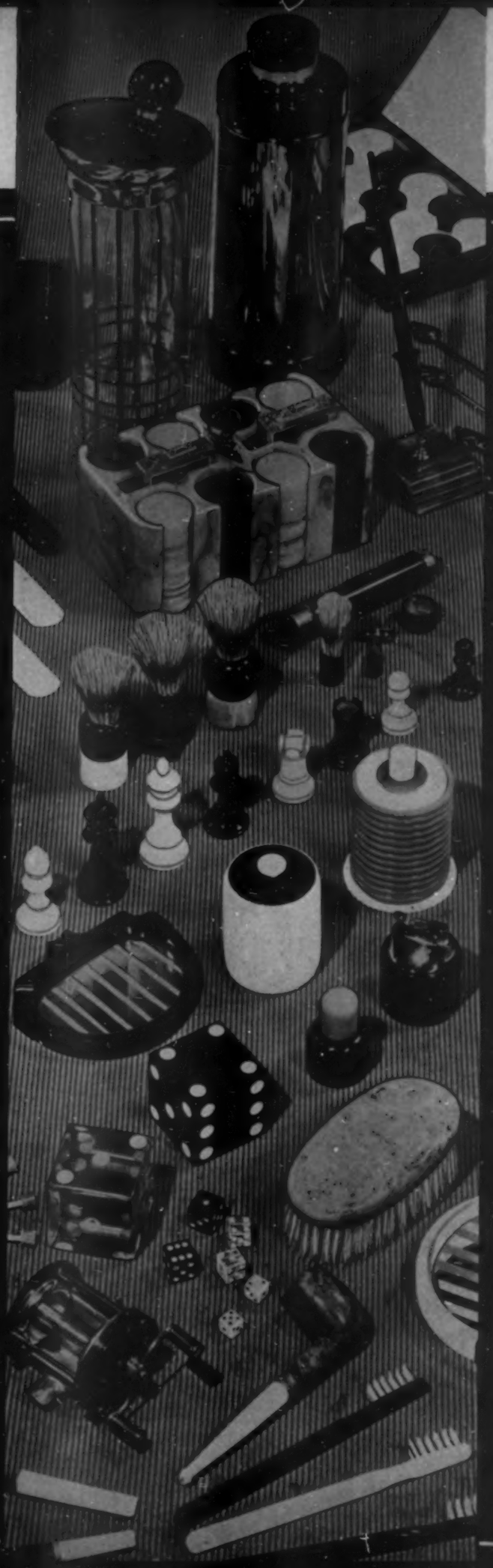

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